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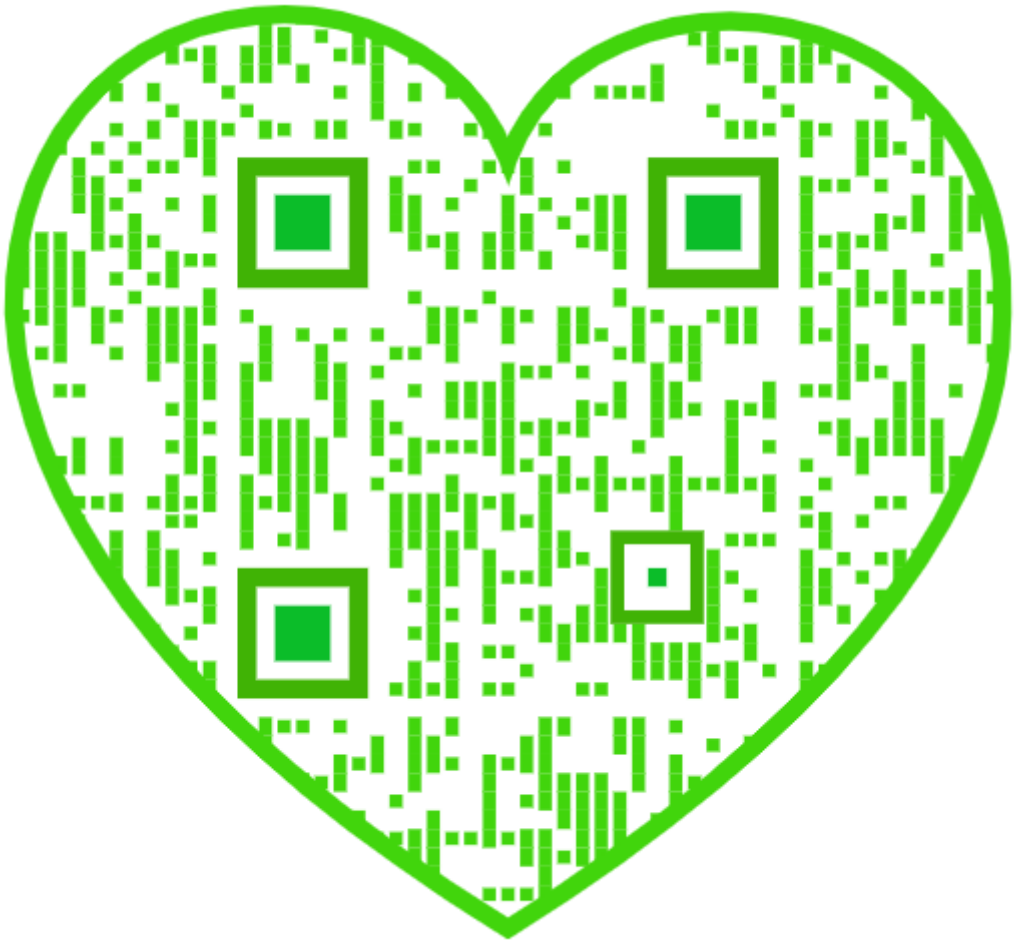
AUTOMOBILE SKATES, THE THOUSAND-LEAGUE BOOTS OF THE TWENTIETH CENTURY.—[See page 306.]



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NEW YORK, SATURDAY, APRIL 14, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

MORE LIGHT ON TURBINE ECONOMY.

The great activity shown by the British ship and engine builders in the development of the steam turbine is giving to the world, very rapidly, important data on the question of the efficiency of the new prime mover. So long as the ships were small, and small-sized propellers and high speed of revolution were possible, the turbine shows a truly astonishing gain of economy over the reciprocating engine; but with the increase in size of ships and propellers, the margin of economy between the two types has gradually been narrowed down, until, in the latest turbine steamships, it has practically disappeared. This is due to the fact that the reduction in size, weight, space occupied, and fuel consumption of the turbines in the earlier vessels, was due largely to the high speed of revolution that was possible. But since the turbine and the propeller are on one and the same shaft, there came a time, as the ships grew larger, when the speed of revolution had to be kept down in order to maintain propeller efficiency. The efficiency of the propeller increases with the diameter and with the decrease of revolutions; whereas it is just the contrary with the turbine, whose efficiency increases with increase of revolutions and with a decrease of the diameter of the drum.

It is because of these fundamental principles that some of the recent turbine-driven ships of the larger size have not shown such favorable results in sea service as they did on trial. Of course, all ships fall off somewhat, in their regular sea service, from the figures of speed and economy obtained on trial; but the discrepancy has been very much larger in the case of turbine-driven ships of the larger size, than it has in ships driven by reciprocating engines. Observations of a large number of well-designed twin-screw reciprocating-engine vessels has shown that the effective propeller thrust at sea, compared to the results on the trials, was as about 1 to 1.25, whereas, according to an English authority, in the turbine vessel, the ratio was in one case as 1 to 2.25. It has become evident that a still further modification must be made of the ratio of diameter and speed of the propeller and its turbine; and we shall look to see the size of propellers increased in order to insure that when a ship is being driven into heavy head seas they will develop sufficient thrust to hold the vessel up to its work.

EFFECTS OF SNOW ON THE THIRD RAIL.

An important question affecting the operation of the great system of electric traction which the New York Central Railroad is now installing throughout its suburban and terminal lines, is that of the possible effects of snow upon the third rail with which the new lines will be equipped. In order to determine the action of the snow, the company recently conducted a series of elaborate tests, choosing a time when a rather heavy snowfall had completely covered the third rail to a depth above the top of the same of from four to six inches. In order to secure comparative data on the subject, the track over which the runs were made was provided with several different sections of third rail, each arranged on a different system. Among these were included an ordinary unprotected rail placed head up; a rail with protection over the top; a rail protected at the top and on one side, and also a section of the type of under-running rail, which has been adopted by the New York Central Company. The under-running rail is inverted and covered on the top and side, the contact shoe of the locomotive bearing up from below against the inverted head. In the tests, the locomotive carried a snowplow on the pilot, which failed to throw the snow clear of the third rail. This somewhat vitiated the results, because it acted unfavorably upon the over-running rails. As the result of the trials it was found that the over-running rail gave about the same results, whether it was protected or unprotected; but in both cases the operation was unsatisfactory, for the reason that the passage of the contact shoe failed to remove the snow, which tended to become packed and hard as the shoes forced their way over it. The best results were obtained with the under-running rail, the under-contact surface being kept practically free from snow, while the passage of the shoe left the rail in a cleaner condition for the next trip. As the result of these trials, the company are satisfied that they have in their present form of third rail the best type for winter service.

COMBINED FLOATING AND STATIONARY POWER STATION.

A decidedly novel method of temporarily increasing the boiler capacity of its power plant was recently adopted by a street railway company at Baltimore; and the scheme is so simple, and has such a variety of possible applications, that it is worthy of more than passing notice. It seems that on account of the great damage done to its main generating station during the great Baltimore fire, and because of the prospect of a rapid and immediate increase in its business, the United Railways and Electric Company of Baltimore found that it would have to make emergency provision for increasing its boiler plant, without waiting on the completion of the rebuilding contract which was then under way. In the emergency it was decided to charter a large passenger steamer, the "Lord Baltimore," which is laid off during the winter months, moor it alongside the dock adjacent to the power house, and make some form of flexible steam pipe connection from the steamer to the stationary engines on shore. The steamer carries four 250-horse-power boilers with an overload capacity of from 1,200 to 1,500 horse-power. The boilers were disconnected from the ship's engines, and a 10-inch pipe was run from the main 10-inch steam header in the boiler room of the power station, to the edge of the dock alongside of the steamer, where it terminated in a 10-inch manifold. Another manifold 8 inches in diameter was placed on the upper deck of the steamer, and in order to allow for the rise and fall of the vessel with the tides, the two manifolds were connected by a set of flexible copper tubes. The arrangement proved so satisfactory that, after the emergency which was created by the rush of Christmas travel had passed, the ship was maintained under charter, and the ship's boilers were drawn upon as auxiliaries during that portion of each day in which the power station was carrying its heaviest load.

COMPARISON OF HEAVY ELECTRIC AND STEAM LOCOMOTIVE PERFORMANCE.

That the development of the electric locomotive has by no means rendered the steam locomotive obsolete, was made clear in a paper recently presented before the New York Railroad Club by Mr. J. E. Muhlfeld, general superintendent of motive power of the Baltimore & Ohio Railroad. Indeed, the results of a practical comparison of the two types, as given in this paper, seem to prove that for the hauling of very heavy train loads under hard conditions of service, the biggest freight locomotives are superior to the heaviest electrical locomotives; or, to be more precise, it has been proved that this is true in the case of the particular locomotives upon which the conclusions of this paper are based. The facts will come as a surprise to electric locomotive builders and engineers, for it has been the common opinion that the electric locomotive would show to its very best advantage, especially if it were using the alternating current, in hauling heavy freight trains over the mountain divisions of our railroads.

The author of the paper has been in possession, during the past few years, of unrivaled facilities for making comparative tests of the two types of locomotive, for the Baltimore & Ohio system has in operation six electric locomotives of the most powerful kind, four of which have been in operation for ten years past, while during the past year they have been operating the most powerful steam locomotive in existence, namely, the Mallet duplex, compound, articulated locomotive, which attracted so much attention at the World's Fair The electric locomotives, it will be remembered, were built for the purpose of hauling passenger and freight trains through the two-mile tunnel leading to the new terminal station of the Baltimore & Ohio Railroad in the city of Baltimore. The older locomotives operate as single units and weigh about 98 tons each, while the later electric locomotives are designed in two 80-ton sections; from which it will be seen that these engines are comparable with the heaviest steam locomotives. The compound steam locomotive is carried on two six-wheeled trucks, with the high-pressure engines on one truck, the low-pressure engines on the other. All wheels are coupled and the total weight is available for adhesion. The engine weighs 334,500 pounds, and the draw-bar pull, when it is working compound, is 74,000 pounds, and 84,000 pounds when it is working simple. The total elevation from Connellsville to Rockwood, on the division where the compound has been employed, is 931 feet, the ruling grade being 1 per cent, and the total distance 43.4 miles. Over this road the engine has hauled thirty-six loaded cars, representing a total weight of 2,370 tons, at an average speed of 10 miles per hour.

The results of service show that the total cost of operation and maintenance of the electric locomotive, including in this the generation of the electric current and miscellaneous expenses, has been $34.50 for each hundred miles run by each locomotive. Of this total the cost of the running and shop repairs average $6.10 for each hundred miles. On the other hand, the cost of maintenance of the steam locomotive averaged only $24.50 per each hundred miles, which is about 30 per cent less than the cost of the electric engines for the same distance doing fairly similar work. The cost of shop repairs and general materials amounted to $3.16 per one hundred miles, which is about 50 per cent less than the cost for the same item of the electric locomotive. It was pointed out in the paper that the advantages do not stop here, since the first cost of the electric locomotive alone is, at the present time, about 50 per cent greater, measured on the basis of pounds of tractive power, than the cost of the steam locomotive. Furthermore, there is to be added the disadvantage, in the electric locomotives, that the great concentration of weight on a comparatively short and rigid base is extraordinarily severe on the rails, bridges, and other track structures. The author of the paper draws the conclusion from these comparative data, that, except in the special cases where the use of steam locomotives is undesirable, the greater first cost and cost of operation of electric locomotives would prevent their competing with the steam locomotive for heavy railroad work.

In accepting the facts given in Mr. Muhlfeld's valuable paper, we must be careful not to be led into the error of drawing too broad conclusions from his facts, as gathered on the Baltimore & Ohio Railroad. In the first place, it should be borne in mind that the big freight locomotive has the advantage of having been designed especially for heavy mountain work, and that it so far exceeds the average big freight locomotive in dimensions and power as to be quite in a class by itself. The electric locomotives, on the other hand, can hardly be considered as representing the latest developments of heavy electric traction, either here or abroad. We have no doubt that if electric locomotive builders the world over were invited to design a locomotive for doing exactly the duty which the big steam compound is now doing on the Connellsville division, they would be prepared to build an alternating-current locomotive which would do the work for about the same cost per pound of tractive effort and per hundred miles run as the compound. This, however, would only be possible if the whole line were operated under electric traction, and the particular locomotive was debited merely with its share of the cost of the line and power stations.

THE ORGANIZATION OF THE SUBMARINE FLOTILLA OF THE BRITISH FLEET.

It is anticipated in the forthcoming programme of the British navy for the ensuing year, that the appropriations in regard to the construction and disposition of the fleet of submarines now constituting an important branch of the navy will be a prominent feature. The various and continuous experiments that have been conducted by the Admiralty with the Vickers-Maxim-Holland type of boat of varying displacements have resulted in the evolution of an efficient craft, replete with all the improvements and modifications resulting from the prolonged investigations. Authentic information regarding these latter vessels is somewhat difficult to obtain, but that the majority of the defects inherent in the earlier types of boats have been surmounted is apparent from the important arrangements concerning the organization of these vessels that is now being carried out. The displacement of the submarine has been continuously increased until the most modern craft are upward of 300 tons, and this increase in size has been attended with various important improvements in speed, radius of action both afloat and submerged, and the electric and gasoline engines for propulsion under these respective conditions of traveling. The dimensions of the accumulators and the gasoline tanks have been considerably augmented, thereby effectively rendering the boat more independent of frequent replenishment, the latest type of vessel carrying sufficient liquid fuel for traveling 1,300 miles on the surface.

More important, however, is the prominent part which the submarine is to fulfill in the future defense of the country. The military system of fixed submarine mines at the entrance of rivers and harbors has been taken over in its entirety by the naval department, and in the greater number of cases has been completely abandoned in favor of a more elaborate defensive scheme by submarine boats. Furthermore, the submarine vessel is to constitute a separate department of the Admiralty, which, although acting in complete conjunction with the navy, will, however, be conducted on quite a separate footing, the submarines having their own bases and docking equipment for repairs, overhauling, refitting, and so forth.

It is intended by the Admiralty to organize six submarine-boat bases round the English coasts. Three of these are disposed upon the south coast at Ports-

mouth, Devonport, and Dover respectively, while the remaining three bases will be distributed along the eastern shores on the North Sea, which is the more exposed to attack from the European continent. Portsmouth, owing to the contiguity of the great naval dockyard, will constitute the principal base; but at the same time each station will be so appointed that it will be in a position to be independent of the paramount base, and be able to cope with any emergencies that may arise, such as the refitting, repair after accidents, and replenishing of supplies.

At Portsmouth the base will be quite isolated and independent of the dockyard itself. The situation selected for the station, and upon which the necessary arrangements have been carried to a very advanced stage, is completely isolated by water from all communication with the shore, thereby enabling absolute privacy to be maintained. A small dockyard is being constructed, and is being equipped with all the latest electrical and other power appliances for dealing with the work, together with numerous tanks for storing gasoline. A special type of floating dock is now approaching completion at the works of Vickers, Sons & Maxim, for dealing with submarine craft exclusively.

Similar arrangements and facilities are being carried out at Plymouth, the station in this case being also isolated by water, and at the same time guarding the entrance to the important dockyard at Devonport. At Dover, where the naval harbor is being pushed forward with all possible speed, the situation will comprise a floating workshop and dock near the harbor's entrance. This station will prove an important one in the strategical defensive scheme of the Admiralty, since it guards the Straits of Dover, and thus commands the only means of communication between the English Channel and the North Sea.

Each base is to be provided with a fast depot ship of sufficient speed, so as to be able to render prompt assistance in the event of a submarine breaking down. This vessel will have a torpedo boat to act as a tender.

Owing to the fact that the machinery of a submarine vessel requires frequent overhauling, the exact number of these craft which is to be stationed at each point in actual service, and the extent of the reserves, is not yet finally decided. It is anticipated, however, that each base will be equipped with six active boats, together with a sufficient supply of reserve craft to enable the above minimum number to be available for service at a moment's notice. In view, however, of the satisfaction and success of the latest types of submarines which have been constructed, it has been decided to push ahead with the construction of this class of fighting unit with all possible speed, while the various bases are to be completed and equipped during the present year.

THE ECONOMICS OF NEW YORK'S REFUSE DESTRUCTOR.

Some valuable information on the combined refuse destructor and power plant of New York was given in a recent number of the Engineering Record. Until recently no attempt had been made in America to combine power stations with refuse destructors, nor, in fact, to dispose of the towns' refuse by incineration. A destructor has now been put down capable of dealing with 10,000 pounds of refuse per hour. The refuse is delivered on to an apron conveyor which travels at a rate of about 70 feet per minute, the conveyors being 4 feet wide, having 6-inch sides, and a total length of 89 feet, from the front of the building to the discharge-point above the charging door on top of the furnace. The apron conveyor enables the rubbish to be sorted before it reaches the destructor, and about 60 per cent volume of the entire receipts is removed in this way by the trimming contractor, who pays for this privilege about $1.50 a ton. The 40 per cent which remains is delivered on to the charging platform. The furnaces are of the top-feed type, and each is divided longitudinally into two cells, each cell being 8 feet long by 4 feet wide. The consumption per unit area of grate of course varies with the material burned, but it is found that over 60 pounds of refuse per square foot can be burned under any conditions, so that with a total grate area (two furnaces) of 146 square feet the minimum capacity is about 10,000 pounds per hour. The power plant, which is intended for the lighting of Williamsburg Bridge and adjacent buildings, consists of two Stirling water-tube boilers, each of 200-horse-power capacity at 150 pounds per square inch, with economizer and auxiliaries; two 100-kilowatt and one 50-kilowatt direct-connected sets; and a battery for providing a day load. It is estimated that 1 pound of refuse evaporates 1½ pounds of water, which, at 60 pounds per square foot, is 13,140 pounds of steam per hour. The costs of destruction are compared with the previous costs of refuse disposal by dumping. The amount of refuse delivered per day to the destructor is 728 cubic yards, of which 465 cubic yards is taken out by the trimming contractor, leaving 263 cubic yards to be incinerated. The cost of dumping these 263 cubic yards at sea at the lowest rates yet secured would be $58.80. The costs of incineration are: Labor $8.33, foreman, $2.75, watchman, $2.12, sundries and repairs $2.50, interest $2.24: total $17.94. The ashes amount to 3.1 per cent, or 8.15 cubic yards, which must be dumped at sea at the cost of $1.66, bringing the total charges to $19.60, or a saving on the destructor of $34.20, or $10,260 per year of 300 days. This saving gives a return of 51 per cent on the first cost of the destructor, furnaces, and buildings, this cost being about $20,000. This figure, however, does not include the conveyor and boiler plant, as these introduce other economies, namely, the revenue from the trimming contractor and the production of power by means of the steam raised.

PROPOSED NEW YORK, BROCKTON, AND BOSTON CANAL.

It is unquestionably true that one of the most dangerous sections of the coast line of the United States is that between Fisher's Island, Conn., and the extremity of Cape Cod. Major J. A. Willard, of the United States engineer's office at Newport, has prepared a map of this coastal region which shows the approximate location of 1,076 marine disasters, of which all but sixty have occurred within the period between 1880 and 1903. For years many authorities on the subject have advocated the cutting of a canal through Cape Cod, in order to obviate in this way the unnecessarily great and recurring loss to life and property annually suffered in the coastwise shipping industry. A proposal which has been frequently discussed within recent years is the construction of such a canal through the narrow part of the Cape from Buzzards Bay to Cape Cod Bay. A company has, however, been lately formed which has another canal project in view to furnish a route from New York to Boston materially shorter, though the original cost will be greater, than that provided by the above-mentioned canal. This plan is to run the artificial waterway from Fall River, using the Taunton River in part, through Taunton, Brockton, and Weymouth and so into Boston Harbor. That the project is feasible from an engineering standpoint is conceded by the experts consulted, though there are legislative difficulties to be overcome by the backers of the scheme, notwithstanding its undoubted usefulness to future navigation.

RECENT BALLOON ASCENSIONS IN THE VICINITY OF NEW YORK.

In endeavoring to introduce into America ballooning as a sport, Count de la Vaux, the president of the French Aero Club, made an ascension at West Point during the afternoon of Saturday, March 31. The ascension was arranged for by the Aero Club of America, and Charles Levée, a French aeronaut, accompanied the Count. As there was a strong wind early in the day, it was at first thought the ascension could not be made. Later in the day, however, the wind died down to about 12 or 15 miles an hour, and it was decided to make the attempt. The balloon, which was a large one of 18,000 cubic feet capacity, was finally inflated, some two hours being required for this purpose, and the gas being supplied from the government gas plant at the army training station. Shortly after 4:30 P. M. the balloon, carrying the two aeronauts, shot upward from the foot of the hill. The huge gas bag crashed against the branches of a tree on top of the hill, rebounded, and floated south and upward with the wind. The basket struck another tree, but the aeronauts escaped injury.

They threw out sand, soon after the start, which caused the balloon to rise rapidly before it floated diagonally across the Hudson. As soon as it was over the river, it began to descend. It fell so far that the spectators thought it would settle in the river; but finally the aeronauts threw out sufficient ballast to cause it to rise slowly and float with the wind over the hills on the east side of the river. In something like half an hour it disappeared from view over the hills just below Garrison, and in less than another half hour it descended in the vicinity of Peekskill, having covered a total distance of not more than ten miles.

On April 2 the same two aeronauts made an ascent from the Central Union Gas Works, at 138th Street and Walnut Avenue, in this city. This time they took with them Dr. Julian P. Thomas. The balloon, which was one of Count de la Vaux's largest, rose to an elevation of 3,500 feet, and was in the air for three-quarters of an hour. It descended nearby at Glendale, on Long Island, amid a crowd of several thousand persons who mobbed the aeronauts in an effort to obtain souvenirs.

The following afternoon an ascension was made by Paul Nocquet, a young Belgian sculptor of great promise. Nocquet rose from the same starting point at five o'clock, and was carried by a gentle northeasterly breeze slowly across the East River. An hour later his balloon was still above Long Island City, and during another hour it had drifted from Long Island City to Flushing and thence to Jamaica. At 7:50 P. M. it was seen above Cold Spring Harbor, on the north shore of Long Island. At this point it was lost to view. A change in the wind carried it directly toward the ocean. Shortly after ten o'clock it was found at the ocean's edge on Jones's beach, but the aeronaut was missing. Footprints in the sand showed that he had landed safely and had apparently tried to walk to Amityville, the lights of which must have been visible to him some six miles away. To do this he was obliged to swim several streams and cross muddy marshes. In his vain effort to reach the lights he fell exhausted about a mile from the balloon, and his body was found the next day in the marsh. The tragic end of this young man was entirely unnecessary and is well-nigh inexplicable, unless it be that he feared the tide would rise and cover the sand spit upon which he landed, and that he was unacquainted with the locality and did not know its dangers. There was a life-saving station less than a mile from where he landed, and he could easily have spent the night there. The ending of Nocquet's balloon voyage shows that only experienced aeronauts conversant with the country over which they are to travel, should attempt ascensions.

SCIENCE NOTES.

The following method of sticking hot charcoal powder to cold bodies is given by G. Tammann in Ann. d. Physik: On dipping a cold glass rod into hot powdered charcoal containing very little occluded gas, it is found, on withdrawing the rod, that a layer of the powder sticks to the rod, the thickness of the layer increasing with the difference of temperature between the powder and the glass. If the rod remains long enough in the powder to acquire its temperature the phenomenon does not take place, and, on the other hand, if the rod with the powder on it is held until the powder cools, it ceases to adhere. The other forms of carbon do not exhibit the phenomenon, which, however, is independent of the nature of the rod. With SiO_2 powder a slight amount sticks, but this does not fall off on cooling. The author shows by using a glass rod in one experiment and an earthed conductor in another, that the phenomenon is not of an electrical nature, no difference being observed in the two cases; also by performing the experiment in air at 0.5 millimeter pressure and finding no change, he shows that the cause is not to be found in the currents due to occluded gases. He therefore concludes that the attraction is due to a particular kind of field of force only existing with considerable temperature gradient.

Two out of the three types of rays emitted by the radio-active elements, known as the beta- and gamma-rays, are substantially of the same nature as those emitted by a Crookes tube. Thus the beta-ray is the familiar electron in motion and corresponds with the cathode-ray, while the gamma-rays result from the beta-rays in much the same way as the X-rays result from the cathode-rays. The difference is that the X-ray bulb acts under the action of a constant supply of external energy and ceases to work the moment the supply fails, whereas the radio-elements are entirely independent of external stimulus or supplies of energy. In the resemblance between the beta-rays and gamma-rays and the cathode-rays and X-rays of the Crookes tube there is an important difference. The electron which constitutes the cathode-ray travels ordinarily at a speed about one-tenth that of light, whereas the beta-rays of uranium travel with a speed about seven times greater. Like the cathode-rays, the beta-rays are deviated by a magnet, but with much greater difficulty. Some of the beta-rays of radium have a velocity 95 per cent that of light. The beta-rays are not penetrating enough, while the gamma-rays are too penetrating for radiography. Eight centimeters thickness of aluminium are necessary to absorb half the gamma-rays, while Rutherford has shown the effect on an electroscope of the gamma-rays from 30 milligrammes of radium bromide after passing through a foot thickness of iron.

All three radium emanations possess the extraordinary power of imparting to inactive solid objects in the neighborhood a new and distinct type of temporary activity. This "imparted activity" decays also according to regular laws, which are characteristic and distinctive in each case for the different elements from which they are derived. This process has been elucidated and shown to be due to a change occurring in the gaseous emanation. Gradually and continuously it turns into a new type of radio-active matter, non-volatile and so depositing itself as a film upon any solid object available. The films are invisible and unweighable, and are only known by their activity. Nevertheless, if such a surface rendered active by exposure to the emanation is scrubbed with sand-paper, the film is removed and the activity is then found on the sand-paper. In consequence mainly of these and allied phenomena the view was put forward in 1902 by Prof. Rutherford and Prof. Soddy that the radio-elements were in a state of continuous and spontaneous change, capable of an exact quantitative expression, and that the emanations and allied bodies were the products of these changes.

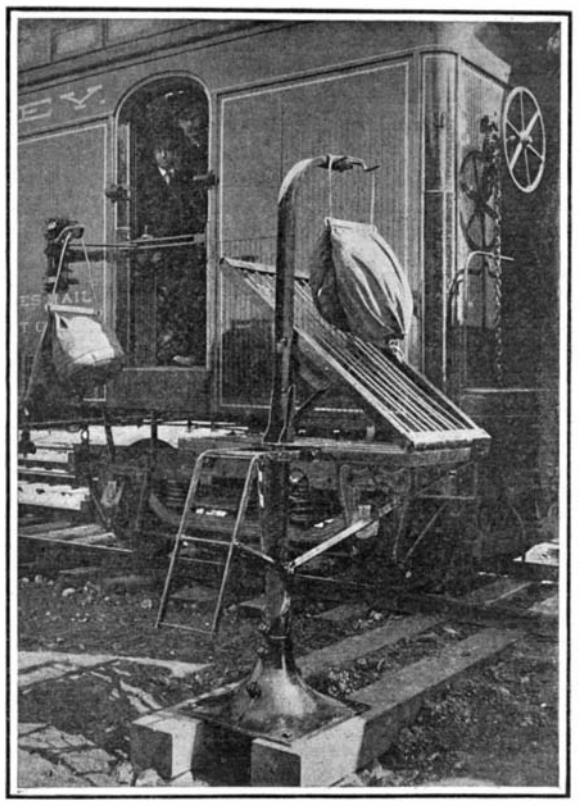
A RAILWAY MAIL CATCHER.

BY W. FRANK M'CLURE.

A new mail catching and delivering device for use in connection with fast trains is attracting no little attention at this time, and, it is understood, is soon to be thoroughly tested by the government. This invention provides for the receipt and delivery of the sacks at the same moment, after the manner illustrated in the photograph. Tests with bags weighing 60 pounds have been made with the train going at the following rates of speed: 6, 15, 20, 30, 35, 40, 50, 60, and 70 miles per hour. The present requirements of the government are that railway mail-catching devices shall work at a speed of 60 miles an hour. Those who witnessed the tests at the different rates of speed enumerated state that, while the machine did not fail to work at any time, the catch was more and more satisfactory as the speed increased.

The crane of this machine is suspended on a swivel post. Suspended from it is a sort of reversible cradle of steel wires. The hook in the crane catches the wire handle which holds the mail sack, and the sack is dropped into the cradle, whereupon the entire machine is swung on its axis by the impact, and it is thus carried out of the way. When another train comes along, even though a trainman may be leaning from the door of an express car or a passenger from a car step, there is no danger of his being struck by any part of the mail-catching and delivering device. This is a most important feature of the new invention. The machine is set anew each time when it is to receive and deliver mail. It will work either forward or backward.

The device in the car door is set by the clerk on the car and locked in place, and the exchange of the sacks takes place automatically without any further attention. The fact that in the exchange each sack is grasped and held securely is another important feature claimed for this machine. This avoids all possible danger of a sack being ground to pieces beneath the train wheels or being otherwise destroyed. M. D. Cummings, an Ohio man, is the inventor of the device. The tests here described were made on the Hocking Valley Road near Columbus.



A NEW MAIL CATCHING AND DELIVERING DEVICE

AN APPARATUS FOR RECORDING THE OSCILLATIONS OF LIGHTHOUSE TOWERS.

BY DR. ALFRED GRADENWITZ.

The oscillations of lighthouses, due to the pressure of the wind, are a serious drawback to their operation, interfering as they do with the regular working of the lighting outfit, and frequently causing fissures in the walls. In order to reduce these oscillations to a minimum, the weight proper of the lighthouse tower should be chosen as high as possible (by constructing the walls of heavy granite slabs or the like), so as to far outweigh the pressure due to the action of the wind.

Special attention has been recently paid in France to this point in the construction of lighthouses, Mr. J. Richard, of Paris, the well-known instrument maker, having been intrusted by Mr. Ribiéré, chief engineer of the lighthouse service, with the design of a recording apparatus, by means of which the oscillations of lighthouse towers could be checked.

This apparatus, which has just been constructed, is installed at the top of the tower, and enables the amplitude of oscillations as well as their frequency to be ascertained with a high accuracy. As seen from the engraving, the apparatus consists of a cast-iron support having three level screws, and is installed on the summit of the tower of which the displacement is to be measured. On this support is placed a fixed glass plate, and bearing on the latter are four steel balls, on which is rested a smoked-glass plate free to move about. A recording pencil carried by a slide is driven by clockwork in a straight line over this smoked-glass plate at a rate of 2 millimeters (0.08 inch) per second.

The clockwork, slide, and drawing pencil are rigidly connected to the support of the apparatus. If the latter be caused rapidly to oscillate, the glass plate resting on the steel balls will remain immovable in virtue of its inertia, and the drawing pencil will record a series of undulations, representing both the frequency of the oscillations and their amplitude, which records may be readily compared with other similar ones.

It is obviously indispensable that the tower should not rock excessively, lest the gravity produce a displacement of the smoked-glass plate. In most cases the oscillations of lighthouse towers will, however, be found to be so slight as to fulfill this condition, their amplitude being far from reaching the figure of 0.6 millimeter (0.024 inch) ascribed to them by L. Fresnel for a period of 1 to 2½ seconds.

The above-described apparatus has been installed on a number of French lighthouse towers of recent construction, where it has borne out their safety of construction, the oscillations being always so weak as to exert no appreciable influence in the case of sufficient strength of the lighthouse.

AN APPARATUS FOR RECORDING THE OSCILLATIONS OF LIGHTHOUSE TOWERS.

A PNEUMATIC DECK-CALKING TOOL.

Numerous devices have been designed for supplanting the tedious, laborious, and protracted system of calking the decks of vessels by hand labor, but these efforts have not proved completely successful, since the various appliances have not possessed a mechanical system of gathering the oakum so that it can be fed into the seams of the deck. An ingenious pneumatic tool for the accomplishment of this work, however, and which has been adopted by the British navy, has been placed on the market by the Pneumatic Engineering Appliances Company, of London, by means of which the whole task, including preparation of the seams and calking, can be carried out without involving any handling of the oakum.

PNEUMATIC DECK-CALKING TOOL IN OPERATION, SHOWING SEAM OPENER AND CALKING IRON WITH PNEUMATIC HAMMER.

The appliance comprises three tools. In the first instance, the seam opener is employed to open the interstice to the desired width to receive the oakum. Then the first calking thread is inserted by the aid of the calking tool, and finally two threads of oakum are calked down on top of the first one by means of the calking iron. The oakum is laid down on the seam in lengths, and one end threaded through the nose of the feeder, as shown in the accompanying illustration. As the feeder is moved along, the oakum is gathered up and is hammered into the seam by a pneumatic hammer, which fits the tool.

The feeder is made of cast steel, and is arranged to fit the apparatus by means of a steel pin, which passes through a double eye-piece, through which the power of the hammer is transmitted. To protect the tool from injury, the bearings are fitted with rubber cushions, and the whole appliance is designed with a view to insuring a long life.

The operation is very simple, and does not call for any particular skill in its manipulation. At the same time, it enables the work of calking to be carried out very expeditiously, and at a speed with which hand work cannot be compared. Furthermore, experience has shown that the work can be carried out much more uniformly by its use. With two sets of tools 690 feet per day can be calked by two apprentice carpenters, while for drumming decks one similar workman can do 900 feet per nine hours. In use the tool has shown a saving of 300 per cent. The British Naval Department are employing the tool extensively for calking the decks of warships, while it is also in operation in numerous shipyards.

Some Automobile Statistics.

Some statistics of unusual interest concerning the automobile industry in the United States have just been brought out in the course of the litigation now progressing against certain manufacturers, dealers, and users for infringement of the Selden patent. The plaintiff in all the suits pending is the Electric Vehicle Company, and in order to prove the extensive recognition which the Selden patent has been accorded by the industry, President H. J. Budlong was called to the stand to testify concerning the amount of business that has been transacted under licenses granted under the patent. A summary of Mr. Budlong's testimony shows the following records to have been kept by the licensors, all the figures having been furnished by manufacturers in depositions under oath. According to these official figures, as sworn to in the United States Circuit Court, the total number of vehicles manufactured and imported under license, from January 1, 1903, to January 1, 1906, was 41,696. The valuation of these cars was $63,141,437.22 and the royalties paid on them to the licensors was $814,183.52. All of the figures given represent cars actually sold.

The increase of production in 1904 over 1903 amounted to 30 per cent in the number of vehicles, and the increase in the value of the gross sales was 58 per cent.

The increase of 1905 over 1904, in the number of vehicles, was 32.5 per cent, while the increase in the value of the product sold rose to 66.2 per cent.

The total business in 1905, according to the testimony, amounted to 17,840 vehicles, having a valuation of $31,814,758.99.

These figures reveal some averages of peculiar interest. Taking the total number of cars produced by the licensed makers and their selling prices, it is shown that the average selling price for cars of all sorts in 1903 was approximately $1,170. In 1904 the average price was $1,422. In 1905 it was $1,784. For the three years 1903, 1904, and 1905 the average selling price of domestic cars was $1,429 and of imported cars $6,710.

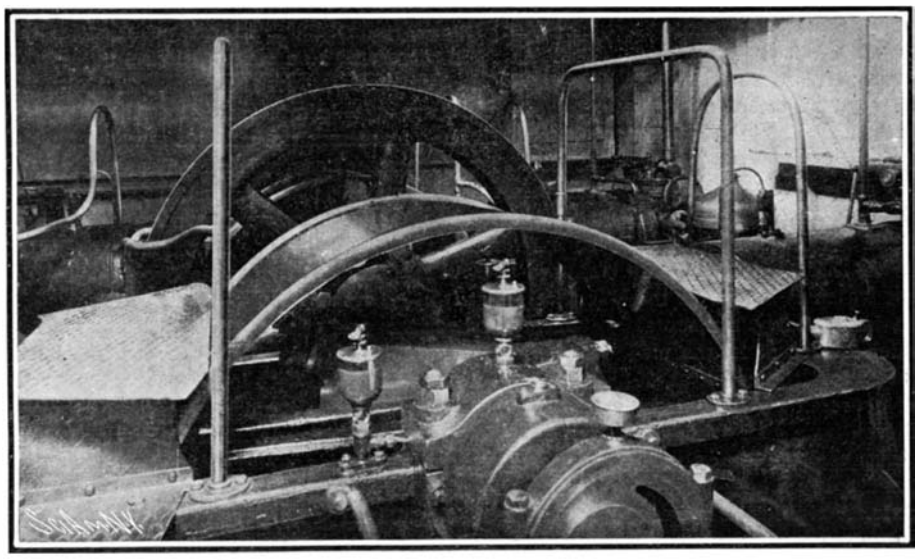
This is the first time that any such thing as reliable, official figures have been furnished; and as there are thirty-seven concerns now operating under the Selden patent, who handle the great majority of all the motor cars made and sold in this country, these statistics from the court testimony throw a broad light on the situation.

An important discovery has been made at Rushan Castle, in the Isle of Man, which dates from the tenth century, the foundations of a minting house having been unearthed. The sunken fireplace is almost perfect, and portions of the crucibles, some copper dross, and a large number of Derby coins were found. It is conjectured that here were minted the coins which the Stanleys made currency when kings of Man.

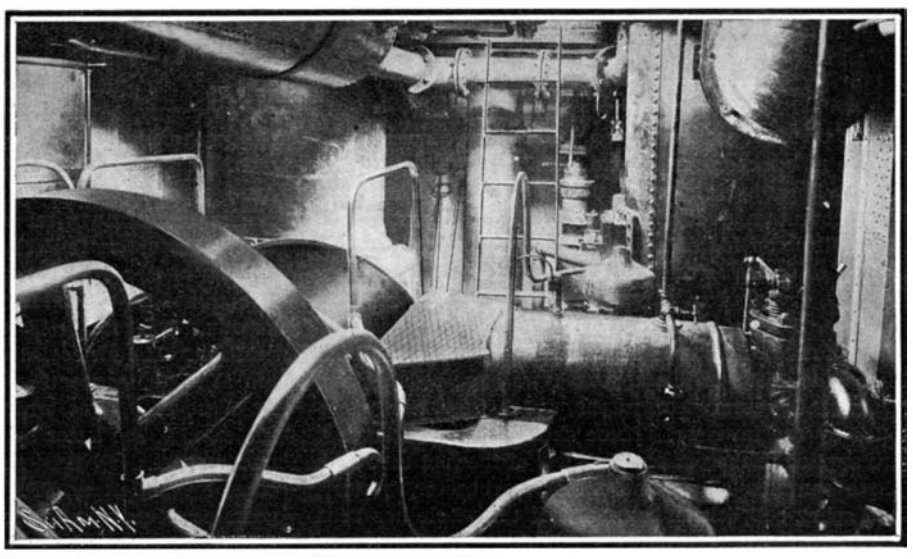
100-HORSE-POWER SUCTION-GAS-PROPELLED BOAT ON THE RIVER RHINE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The utilization of the suction gas engine for certain classes of marine work, such as the propulsion of barges, as designed by the well-known Otto Gas Engine Company, of Deutz, is being extensively developed in Germany for freight-carrying traffic between the inland industrial centers and cities and the principal seaports on the coast. This movement is due to the greater economy that is proved to be derivative from the employment of this system of propulsion, since it enables the craft to be operated much more cheaply than is possible with steam or any other type of traction, while the work can be carried out much more expeditiously and efficiently than by towage either with animal, tug-boat, or other power.



Four-Cylinder, 100-Horse-Power Producer-Gas Engine of the "Lotte." The Engine is Started by a 6-Horse-Power Motor.



Engine Room of the Producer-Gas Boat "Lotte." Producer on the Left. Scrubber in the Right-Hand Corner.

The Otto Gas Engine Company have up to the present fitted their suction gas system upon eleven vessels, the power of the various engines ranging from 35 horse-power to 90 horse-power. In these craft the design of the engine has followed the well-known horizontal arrangement, the number of cylinders in the case of the 35 horse-power engine being two, while for others developing the greater powers four cylinders are employed, in order to obtain a more perfect balancing of the engine. In the case of the 90-horse-power boat the engine has a running capacity up to a maximum of 325 revolutions per minute.

Recently, however, the company have carried out another installation upon similar lines, which possesses especial interest, inasmuch as it is one of the largest installations of this type of plant for river traffic that has yet been designed. The craft in question, known as the "Lotte," is a flat-bottomed barge such as is generally used for this class of work, measuring 139 feet 6 inches in length with a beam of 15 feet, and having a draft of 6 feet 6 inches with a load of 240 tons. The engine, which is of the four-cylinder horizontal type, develops a maximum of 100 horse-power. It was originally designed for service upon the River Elbe, but when it was completed by the engine builders it was retained by them for their own river traffic between Cologne, Antwerp, and Rotterdam, a total distance of about 190 miles.

The engine, together with its necessary equipment comprising the producer, scrubber, etc., occupies but little space, being very compact and with the integral parts placed conveniently together, as the accompanying illustrations show. The gas producer is placed in front of the engine room and separated therefrom by a bulkhead with sliding doors, which may be closed during the time the grate of the gas producer is being cleaned and the ashes and clinker removed. In the opposite corner is placed the scrubber, while over the engine is carried the gas equalizing box. The engine is placed athwart the vessel, so that the crankshaft extends centrally, and in the same longitudinal plane as the propeller shaft, to which it is connected. The flywheel is placed between the sets of twin cylinders, is about five feet in diameter, and of heavy proportions.

For facilitating starting there is a small single-cylinder motor developing 6 horse-power, and driven by benzine fuel, which sets the main engine in motion by means of a frictional connection with the flywheel, this coupling being continued until the ignition in the cylinders of the larger engine commences, and the latter has attained sufficient momentum to run without further assistance, when the small motor is thrown out of gear. This benzine engine also drives through belting and shafting a small fan-blower that is brought to bear upon the fuel in the producer, after the engine has been standing stationary for some time, thereby enlivening the combustion of the fuel within the gas producer.

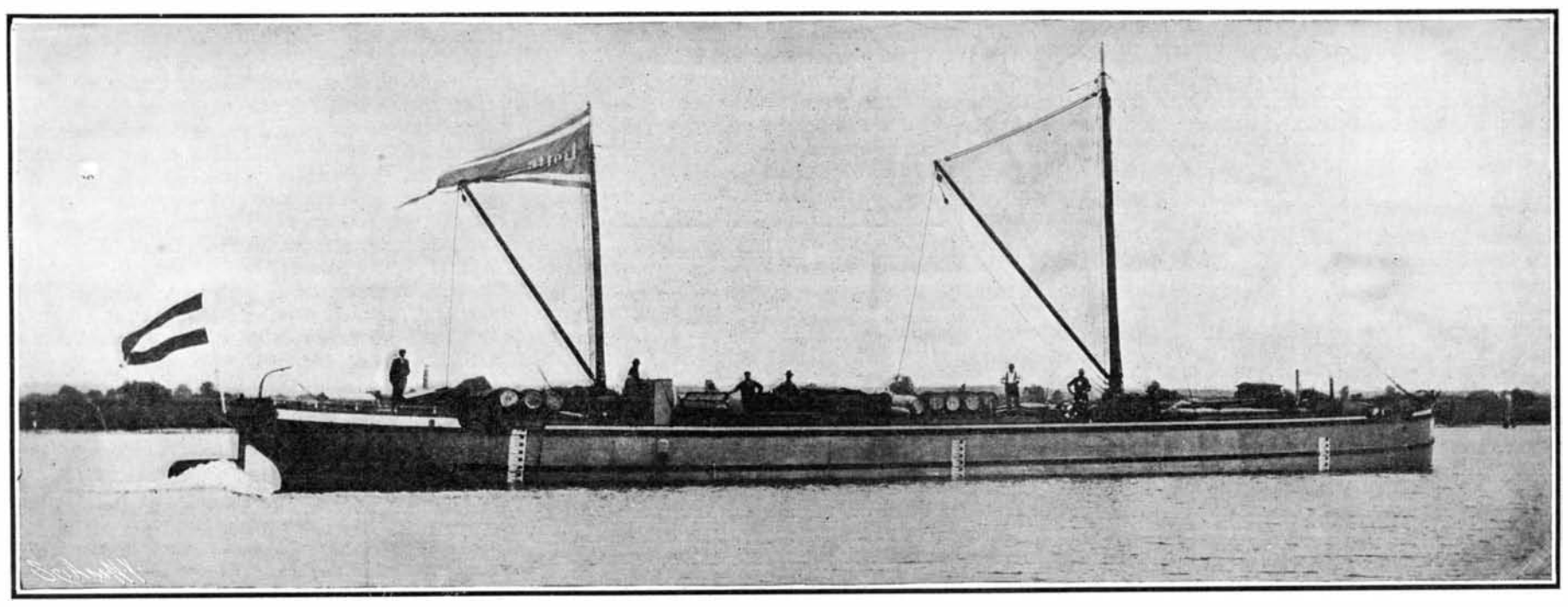
The power exerted by the engine varies from 80 to 100 horse-power, and at the latter maximum power the engines are capable of driving the boat with a full load of 250 tons, at a speed of 3½ miles per hour against the current in the river, which at some places is somewhat swift and powerful. The total space occupied by the engines and necessary generating plant is approximately 14 feet in width by 20 feet in length.

Propulsion is carried out by a single screw 4 feet 3 inches in diameter, fitted with four blades which are made reversible in direction by a rack-and-pinion motion. The reversing gear constitutes an interesting feature of the vessel. The rod which carries out the reversing motion ends in a series of toothed racks which gear with corresponding pinions on the axes of the reversible propeller blades. There is a combination comprising a friction coupling, differential gear wheels, toothed clutches, and helical gearing, through which the power requisite for reversing is taken from the main engine shaft, and the action of this combination causes the reversing rod to be moved backward or forward as the case may be. To operate the mechanism the clutch is thrown either into the forward or back gear by the manipulation of the frictional coupling with the main engine shaft. It is also possible to vary the pitch of the propeller blades in accordance with the action of the engine, there being a divided scale, and by varying the pitch in consonance with this it can be gradually increased until the maximum load is attained.

This vessel has proved highly economical in operation. The distance between Cologne and Rotterdam is 187½ miles, and the time occupied on the round trip including all stoppages, with an average load of 200 tons, occupies fourteen days, giving an average daily run of 27 1-7 miles under all conditions, thereby enabling twenty-six round journeys per year to be accomplished. The cost of the vessel is approximately $11,250 and the annual expenses of operation, maintenance, etc., work out as follows:

Depreciation on hull, 5 per cent on $5,000	$250.00
Depreciation on engines, 10 per cent on $6,250	625.00
Interest on capital, 5 per cent on $11,250	562.50
Insurance	11.25
Navigation dues, 26 round trips	975.00
Fuel—anthracite at $5 per ton—burned at the rate of 1.32 pounds per horse-power hour for 75 hours per round trip, 50 hours upstream and 25 hours downstream — 117 tons	585.00
Lubricating oil, etc.	243.75
Wages	1,750.00
Total annual outlay	$5,002.50

During the year, 5,200 tons were carried, representing 1,950,000 ton miles, which corresponds to a cost of about 0.25 cent per ton. Had the material been transported from Cologne to Rotterdam by the ordinary steamboats, the tariff for transport would have been about 50 per cent higher, while the lowest rate by the railroad would have been five times as much. On the Saarbrücken-Mühlhausen canal there is a barge of 240



THE SUCTION-GAS-PRODUCER BOAT "LOTTE."

tons fitted with a similar engine, and in this case the round trip of 170 miles occupies thirty days, including nine days' detention, and nine days with light load. Under these disadvantageous conditions the cost of transport by the suction-gas propelled craft is 33 per cent lower than that of horse traction, while the boat during the year makes eleven round trips as compared with seven complete journeys which were possible by animal traction before the introduction of the present system.

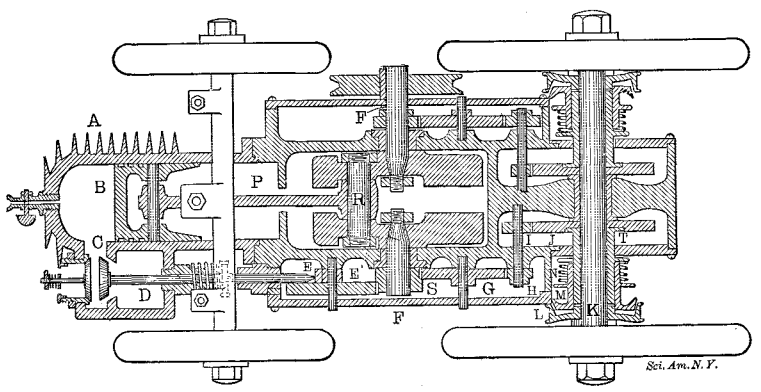
MOTOR ROLLER SKATES.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The new motor skate which has been lately brought out at Paris by M. Constantini, a well-known inventor of carbureters and other devices for automobiles, is attracting considerable attention owing to its novelty, seeing that this is the first time that a gasoline motor has been applied to a roller skate. A short time ago we gave a description of this apparatus, which was exposed for the first time at the Paris Automobile Show. Since the above article appeared we have been able to secure the present photographs, which were kindly supplied by the inventor. These show the skates as they are applied to the person. In view of the fact that each skate contains a gasoline motor, carbureter, battery, and spark coil, it will be seen that the whole has been reduced to a comparatively small size. The use of the rubber-tired wheels is found to give a very smooth-running movement. On the back of each skate will be observed the small sheet-iron box which contains the battery and the spark coil. From the box a pair of wires protected by rubber tubing passes up to the leather belt which the person wears, and upon the belt is placed the switch by which he is able to make or break the ignition circuit when he wishes to start or stop the motor or to regulate its speed. On the back part of the belt is fixed a small gasoline tank in the form of a flat and slightly curved sheet-iron box. From this reservoir a small rubber pipe specially treated to withstand the deteriorating action of gasoline runs down to the skate and connects with each of the carbureters. A second controlling device fastened to the belt enables the person to adjust the gasoline feed from the tank to each of the motors. The gasoline reservoir is made to hold from one-quarter to half a gallon of fuel. Owing to its small size and flat form it occupies but little room and, as will be observed, is covered by the coat, leaving nothing visible but the tubes and wire running to the skates. Each motor weighs 4 kilogrammes (8.8 pounds) and consumes a liter of gasoline per 60 kilometers (¼ gallon every 35 miles). The weight of the skate complete is but 6 kilogrammes (13.2 pounds), and speeds of from 3 to 25 miles an hour are obtainable with it. To start, the operator turns on the gasoline, relieves the compression by means of a special valve-raising lever, and then skates along the road. As soon as he has gotten under way, he switches on the ignition current, and the motors begin to operate. If the novice does not take care to lean forward at this moment, the sudden acceleration may upset him. To stop, it is only necessary to break the ignition circuit or to raise one's self upon the front wheels. By doing the latter, the driving wheels are raised off the ground and the motors race, running free. If one motor runs faster or better than the other, the operator can correct this by moving that foot back of the other, or by bearing more weight upon the faster-running skate. M. Constantini has given the new skate a very thorough trial and has been exercising with it in the parks near the city. He finds that a person can travel either at slow speed or at quite a rapid rate, and that he soon becomes accustomed to using the device, and to controlling the speed of the motors easily.

At present the inventor is engaged in constructing two different types of motor skate. The first of these is the one we have already described in detail in a preceding number, and which is shown in the present illustrations, it having been but slightly improved in the details since the last account. Since then the inventor has designed a new form of motor skate, which he has already constructed at his factory. In the second form the exterior of the skate remains about the same, but otherwise it differs considerably from the one just mentioned. The main difference lies in the fact that only one of the skates is fitted with a gasoline motor, and the latter is made to drive the second skate by means of a rod which passes across and connects the two. The rod has a universal joint on each end at a point near the skate, and is attached at one end to the motor body and at the other to the frame of the second skate. In this way the rod keeps the skates spread at the right distance and makes the whole system quite steady, especially as the feet cannot spread accidentally too far apart, such as often happens with roller skates. In practice it is thought that there will be no disadvantage in having the two skates thus connected together. The motor has been made larger in this case and has power enough to operate both skates. This form is intended to be used by sportsmen, for races, and in all cases where a high speed is wanted, while the first form is adapted for moderate speeds.

In the second form of skate, of which we give a sectional view, the available space between the four wheels is almost entirely taken up by the large motor and its carbureter, while the space under the second skate is utilized to stow the gasoline tank, which is of considerable size, and also the battery and spark-coil, thus dispensing with the double battery and coil which the first system uses. The gasoline tank has a capacity of about a gallon, and this is found upon trial to be enough for a run of 50 or 60 miles. A rubber tube passes across along the rod to take the gasoline over to the motor on the other skate. A novel feature is the use of two different speeds on the wheels, and this is obtained by the arrangement which is shown in the section. The motor is placed in a nearly horizontal position. The air-cooled cylinder is seen at *A*, the piston at *B*, the connecting rod at *P*, and the crank at *R*. At *C* are the valves, which are operated by a rod from the cam, *E*, the latter being driven by a gear from the motor shaft. This shaft is in two halves, as indicated by the letters, *FF*. From the upper half a set of gears connects with the rear axle. A similar gear train is driven from the lower half. The two gear trains have different ratios and they can be connected with the rear axle by a friction clutch on either side. Thus, on the lower side we have the pinion, *S*, mounted on the motor shaft, working with the gear, *G;* and then the pinions, *H* and *I*, mounted on a countershaft, and the gear, *J*, on the rear axle. The latter gear is mounted on a collar, *T*, which runs loose on the axle. Keyed to the collar and sliding upon it is the friction cone, *M*, which is pressed down by the spring, *N*. This cone works in a second cone, *L*, which is keyed fast to the axle. By operating a lever we allow the spring to throw in the lower clutch and thus obtain a given speed on the rear axle. Throwing out this clutch and operating the upper



HORIZONTAL CROSS-SECTION OF THE LATEST FORM OF MOTOR ROLLER SKATE.

one gives a second speed from the other train of gears, which has a different speed reduction. M. Constantini expects to organize a special event in order to bring his system to the attention of the public. Three sportswomen equipped with the skates are to have a race over some of the principal avenues of the city, from the Place de la Concorde to the Maillot Gate, where the paving is either asphalt or wood, and has a smooth surface. Racing events are also to be held in the Velodrome. To show the interest which the new device has already awakened, we may state that the Shah of Persia has ordered three pairs of the motor skates. The inventor has already had several flattering offers for the sale of the English and American patents.

Official Meteorological Summary, New York, N. Y., March, 1906.

Atmospheric pressure: Mean, 30.09; highest, 30.90; lowest, 29.45. Temperature: Highest, 55; date, 27th; lowest, 16, date, 24th; mean of warmest day, 50; date, 27th; coldest day, 21; date, 23d; mean of maximum for the month, 40.6; mean of minimum, 29.2; absolute mean, 34.9; normal, 37.6; average daily deficiency compared with mean of 36 years, —2.7. Warmest mean temperature for March, 48, in 1903; coldest mean, 29, in 1872. Absolute maximum and minimum for this month for 36 years, 74, and 3. Precipitation: 5.58; greatest in 24 hours, 2.44; date, 3d and 4th; average for this month for 36 years, 4.09; excess, +1.49; greatest precipitation 7.90, in 1876; least, 1.19, in 1885. Snow: 13.4. Wind: Prevailing direction, northwest; total movement, 12.017 miles; average hourly velocity, 16.2 miles; maximum velocity, 64 miles per hour. Weather: Clear days, 7; partly cloudy, 12; cloudy, 12.

One of the London motor omnibus companies annually writes 25 per cent off the value of its motor vehicles for depreciation. This is more than some advocates of motor traffic deem necessary, but omnibus work is much more severe on the vital parts than that of other forms of motor vehicles.

The Electric Production of Nitrates from the Atmosphere and Its Significance to Mankind.*

BY PROF. SILVANUS P. THOMPSON, D.SC., F.R.S.

As the demand of the white races for wheat as a food-stuff increases, the acreage devoted to wheat-growing increases, but at a less rapid rate; and, being limited by climatic conditions, it will, in a few years, perhaps less than thirty, be entirely taken up. Then, as Sir Wm. Crookes pointed out in his presidential address in 1898, there will be a wheat famine, unless the world's yield per acre—at present about 12.7 bushels per acre on the average—can be raised by the use of fertilizers. Of such fertilizers the chief is nitrate of soda, exported from the niter beds in Chili. The demand for this has risen from 1,000,000 tons in 1892 to 1,543,120 tons in 1905; and the supply will, at the present rate, be exhausted in less than fifty years. Then the only chance of averting starvation lies, as Crookes pointed out, through the laboratory.

In 1781, Cavendish had observed that nitrogen, which exists in illimitable quantities in the air, can be caused to enter into combination with oxygen, and later he showed that nitrous fumes could be produced by passing electric sparks through air. Although this laboratory experiment had undoubtedly pointed the way, though the chemistry of the arc flame had been investigated in 1880 by Dewar, and though Crookes and Lord Rayleigh had both employed electric discharges to cause nitrogen and oxygen to enter into combination, no commercial process had been found practical for the synthesis of nitrates from the air until recently.

After referring, in passing, to the tentative processes of Bradley and Lovejoy, of Kowalski, of Naville, and to the cyanamide and cyanide processes, attention was directed to the process of Birkeland and Eyde, of Christiania, for the fixation of atmospheric nitrogen, and their synthetic production of nitrates, by use of a special electric furnace. In this furnace an alternating electric arc was produced at between 3,000 and 4,000 volts, but under special conditions which resulted from the researches of Prof. Birkeland; the arc being formed between the poles of a large electro-magnet, which forced it to take the form of a roaring disk of flame. Such a disk of flame was shown in the lecture theater by a model apparatus sent from Christiania.

In the furnaces, as used in Norway, the disk of flame was 4 feet or 5 feet in diameter, and was inclosed in a metal envelope lined with firebrick. Through this furnace air was blown and emerged charged with nitric oxide fumes. These fumes were collected, allowed time further to oxidize, then absorbed in water towers or in quicklime, nitric acid and nitrate of lime being the products. The research station near Arendel was described, also the factory at Notodden, in the Hitterdal, where electric power to the extent of 1,500 kilowatts was already taken from the Tinnfoss waterfall for the production of nitrate of lime. This product in several forms, including a basic nitrate, was known as Norwegian saltpeter. Experiment had shown that it was equally good as a fertilizer with Chili saltpeter, and the lime in it was of special advantage for certain soils. The yield of product in these furnaces was most satisfactory, and the factory at Notodden, which had been in commercial operation since the spring of 1905, was about to be enlarged; the neighboring waterfall of Svaelgfos, being now in course of utilization, would furnish 23,000 horse-power. The Norwegian company had further projects in hand for the utilization of three other waterfalls including the Rjukanfos, the most considerable fall in Telemarken, which would yield over 200,000 horse-power. According to the statement of Prof. Otto Witt, the yield of the Birkeland-Eyde furnaces was over 500 kilogrammes of nitric acid per year for every kilowatt of power. The conditions in Norway were exceptionally good for the furnishing of power at exceedingly low rates. Hence the new product could compete with Chili saltpeter on the market, and would become every year more valuable as the demand for nitrates increased and the natural supplies became exhausted.

Aluminium Breastplates.

The Italian expert, Scandroglio of Leglano, has prepared three kinds of breastplates. The first is composed of six plates of pure aluminium 0.5 millimeter thick, rolled, placed one on another, and wrapped in sized cotton canvas; it resists lead projectiles of 10.35 millimeters in caliber. The second is formed of two plates of aluminium with 4 per cent of copper, rolled, 2 millimeters in thickness, and covered with sized canvas. It stops the projectile of the Italian revolver of the 1889 model. The third breastplate contains three plates of the same metal, 5 millimeters thick, and stops the ball of the Italian musket of the 1891 model. These breastplates are claimed to be less thick and heavy than those previously used with the same results.

* Abstract from a discourse delivered at the Royal Institution, London.

Correspondence.

The Extension of Patents.

To the Editor of the SCIENTIFIC AMERICAN:

The idea of extending patents that have been unprofitable does not insure that the extended patents will prove better, and leads to repeated extensions and therefore to perpetual patents. If that is good doctrine on patents, then whoever fails in any enterprise may call on Congress to set him on his feet again.

Patents are granted for the encouragement of the originating of *new* inventions, not to stimulate the working of *old* devices, and the absence of extensions will have not the least adverse influence on invention. If the inventor gets rich, well and good; if not, his is certainly not the only field of broken hopes.

Formerly patents were granted for fourteen years, with seven years' extension, making twenty-one years. When the extension law was repealed, patents were issued for seventeen years. That seemed a long time; but if it is thought too short, then the most we should do in justice to the public would be the twenty-one years of the old-time extended patents.

The encouragement of invention does not consist so much in the length of time for which patents are granted as in the ease with which patents can be obtained; and in this direction there is great room for improvement. The present seventeen years is long enough, and if patents were granted on hundred-year terms, it would not stimulate invention in the least over the present rate. J. F. HARTMANN.

Providence, R. I., April 2, 1906.

Chanute on the Wright Brothers' Achievement in Aerial Navigation.

To the Editor of the SCIENTIFIC AMERICAN:

Upon my return last evening from a ten days' trip to New Orleans I received your letter of 19th and telegram of 29th instant, asking me for a verification of the statement in the Illustrirte Aeronautische Mitteilungen, that I witnessed a flight of about half a kilometer by the aeroplane machine of the Wright brothers.

This is quite true. The Wright brothers have for the past two years been in possession of a successful flying machine driven by a motor, to my certain knowledge, and have been gradually perfecting it.

On the 15th of October, 1904, I witnessed a flight of 1,377 feet performed in 23 4-5 seconds, starting from level ground and sweeping over about one-quarter of a circle, at a speed of 39 miles per hour. The wind blew at some six miles per hour, but in a diagonal direction to the initial course. After the machine had gone some 500 feet and risen some 15 feet, a gust of wind struck under the right-hand side and raised the apparatus to an oblique inclination of 15 to 20 degrees. The operator, who was Orville Wright, endeavored to recover an even transverse keel, was unable to do so while turning to the left, and concluded to alight. This was done in flying before the wind instead of square against it as usual, and the landing was made at a speed of 45 to 50 miles an hour. One side of the machine struck the ground first; it slewed around and was broken, requiring about one week for repairs. The operator was in no wise hurt. This was flight No. 71 of that year (1904), and on the preceding day Wright brothers had made three flights—one of 4,001 feet for less than a full circuit of the field, one of 4,903 feet covering a full circle, and one of 4,936 feet over rather more than a full circuit, alighting safely.

The illness of a near relative, who had to be taken to the seashore, prevented me from being present at the greatly longer flights of September and October, 1905, but I visited Dayton in November, on my return, and verified the absolute accuracy of the statements which the Wrights have since made, over their own signatures, to the Aérophile of Paris and to the Aero Club of New York. There is no question in my mind about the fact that they have solved the problem of man-flight by dynamic means.

Believing that this solution had a money value, they have, until recently, preserved whatever secrecy they could, particularly when those who chanced to learn of their experiments made inquiries as to the construction and details of their apparatus; but since the French papers have published that negotiations were pending for the use of their machine, they have given some particulars of their performances. As the first use will be in war, it is my belief that the various purchasers will desire to preserve such secrecy as may be practicable concerning the further developments.

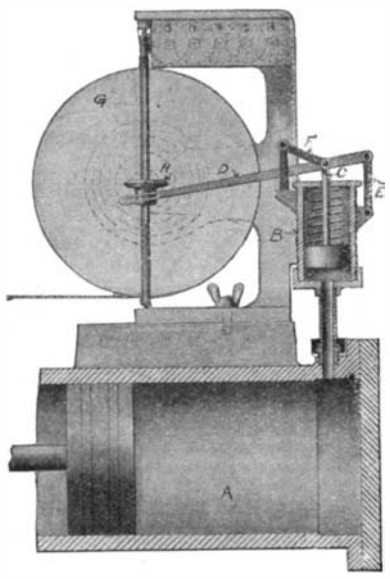
In addition to the great feat of inventing a practical flying machine the Wright brothers have, in my judgment, performed another improbable feat by keeping knowledge of the construction of a machine, which can only be operated in the open, from the incredulous but Argus-eyed American press.

I send you a page cut from The Car of London, which may prove of interest. The Aérophile of Paris for December, 1905, and January, 1906, contains fuller accounts. O. CHANUTE.

Chicago, Ill., March 31, 1906.

AN IMPROVED ENGINE INDICATOR.

A recent invention provides a simple device by means of which the actual horse-power hours delivered by steam engines may be easily and readily ascertained without the necessity of taking an indicator card and estimating the power therefrom. This end is secured by providing an instrument adapted to be attached to an engine, and by which a reading is attained accounting for the stroke, piston speed, or number of revolutions and the pressure, so that by multiplying this reading by the diameter of the cylinder in inches, the actual horse-power hours delivered may be ascertained. In practice two of these instruments are used on each double-acting cylinder. In the accompanying illustration an engine cylinder is shown in section at *A*. This is connected by a pipe with a small indicating cylinder, *B*. Within the cylinder, *B*, is a piston normally held in its lowest position by a coil spring. The piston rod, *C*, is connected at its outer end to the lever, *D*, which in turn is connected by a link, *E*, to the cylinder, *B*. The piston rod, *C*, is also connected by a link, *F*, to a fixed standard on the cylinder, *B*. The outer end of the lever, *D*, is slotted to engage a pinion on a friction wheel, *H*, which is adapted to engage a large friction disk, *G*. The wheel, *H*, is splined to a shaft, which is provided with a worm at its upper end, operating the gearing of a counting mechanism. The disk, *G*, is attached to a clock spring, as indicated by dotted lines, and is, also, connected by a cord to the cross-head of the engine, so that it is caused to revolve in one direction by the action of the cross-head, and in the opposite direction by the spring. The pressure in the working cylinder moves the arm, *D*, and in this way the friction wheel, *H*, is shifted across the face of the disk. The former is thus driven at a speed and in a direction corresponding to its position on this disk. It, therefore, follows that upon the operation of the engine, the disk, *G*, is given a back-and-forth rotation



AN IMPROVED ENGINE INDICATOR.

corresponding to the length of the stroke and the piston speed, and that this is communicated to the counter under the control of the working pressure. Hence a reading may be taken from the counter which, when multiplied by the diameter of the working cylinder in inches, will find the actual horse-power hours delivered during the period that the apparatus has been in operation. If compression exists in the cylinder, the complete return of the friction wheels to the zero position illustrated will be prevented, thus reducing the reading of the counter, and if a condenser is used the partial vacuum will cause the friction wheel to pass below the center of the disk, and the benefit of the vacuum will be recorded. A patent on this improved indicator has been granted to Mr. William F. Lloyd, care of Philadelphia Electric Company, northeast corner of 10th and Sansom Streets, Philadelphia, Pa.

The Current Supplement.

The current SUPPLEMENT, No. 1580, is opened by Dr. Erlwein with a well-illustrated article on the Sterilization of Water by Means of Ozone. Dr. Erlwein is one of the foremost authorities in Europe on this subject, for which reason his observations are worthy of more than usual attention. "Reservoir, Fountain, and Stylographic Pens" is the title of an elaborate monograph by Mr. J. P. Maginnis. The first installment appears in the current SUPPLEMENT. Of technological interest is an article on a rational process for obtaining ammonia and sal-ammoniac by the utilization of residuary and waste products. J. J. Carty, perhaps the leading telephone expert of this country, writes on the modern telephone switchboard. A second series of "Valuable Alloys" is published. A brief history of the marine turbine is presented. C. N. Edge analyzes the utilization of power in automobiles. The recent advances in the bacteriology of putrefaction are reviewed by Mr. J. T. Thompson.

Automobile Notes.

A new fuel consumption record was made recently in France by an experienced chauffeur, M. Bablot, with a 16-22-horse-power four-cylinder Berliet touring car carrying four people. This heavy machine was driven 100 kilometers (62.1 miles) in 1 hour, 21 minutes, and 11 3-5 seconds on the Salon road, with a fuel consumption of but 9 liters (2.37 gallons). This means an average speed of 45.95 miles an hour on a consumption of one gallon every 26.2 miles. When it is considered that the usual touring car of this type covers, as a rule, but 12 or 15 miles per gallon, it will be readily seen that this performance was quite remarkable. It is laid to skillful driving, an improved automatic carbureter, and the kind of fuel—"automobiline"—used. The Berliet car is made in this country by the American Locomotive Works, at Providence, R. I.

The American Automobile Association last week requested the National Association of Automobile Manufacturers to draw up a set of rules for the Glidden trophy tour of this year. After considering the matter, however, the latter association found it difficult to formulate a set of rules which would make it possible for the officers of the A. A. A. to pick the best car from among all the different types that might possibly compete, and consequently, no rules were determined upon. If we understand the matter rightly, the Glidden cup was given to be awarded annually to the best American touring car. This, we take it, means the car which will carry a given number of passengers comfortably through the daily runs of the tour at a fair average speed and with the least trouble to its occupants. Nothing was said about the cost of running, but this, it seems to us, should be the next consideration. If the contest is confined to touring cars, as it seems to have been heretofore, it would appear quite possible to formulate a set of rules which would make it easy to determine the winner, not by the mere choice of contestants, as was done last year, but from an accurate record of daily performances. This would show just what a touring car will do under actual touring conditions and would bring out both the good and the bad features of all the cars in the contest. We trust that the A. A. A. will draw up a suitable set of rules itself for conducting the 1906 Glidden tour in a scientific manner, and that thus America's great annual contest for pleasure vehicles will be put in the same class with similar contests held abroad.

The European circuit is to be one of the leading automobile events of the year. The international committee which has the affair in charge had a meeting not long ago in Paris and drew up the official rules. We give a short extract of these regulations. The French, German, Austrian, Belgian, and Italian clubs are the organizers, and the event will be an endurance test. It will be run in Europe over a 3,000-mile circuit, in fifteen stages, which vary from 150 to 250 miles. Fine expositions will be organized in France and other countries. Space will be free, except in France. In between the stages of the race the cars, although exhibited to the public, are placed in a space to which all access is forbidden, for making repairs, etc., according to what is known as the "inclosure system." Repairs must be deducted from the time of the race itself. It is decided to hold the exhibitions of the cars at Toulouse, Grenoble, Milan, Vienna, Berlin, and Cologne. Four classes are recognized for the cars: 1. Cars whose total piston surface does not exceed 86.59 square centimeters (13.42 square inches) corresponding to a 4-inch bore. A two-place car is to be used, with 170 pounds least weight of carriage body. 2. Piston surface of 226.19 square centimeters (35 square inches) or 4.8 inches bore for a two-cylinder motor. The car is of the double phaeton type, with four places. Least weight of body, 900 pounds. 3. Total piston surface 346 square centimeters (53.6 square inches) or 4-inch bore for a four-cylinder motor. Carriage body having four places and a least weight of 830 pounds. 4. Piston surface, 88 square inches. Four places inside and two in front, with a least weight of 1,000 pounds for carriage body. The engagements should be sent to the Automobile Club of France, 6 Place de la Concorde, before June 15, with payment of $200, $300, $400, and $500, according to class, together with all the data as to the cars. Each of the above clubs will send three delegates to the jury. Diplomas, in the proportion of one-fifth of the whole number of cars engaged, will be awarded for the best performance.

Consumption of Calcium Carbide in Europe in 1905.

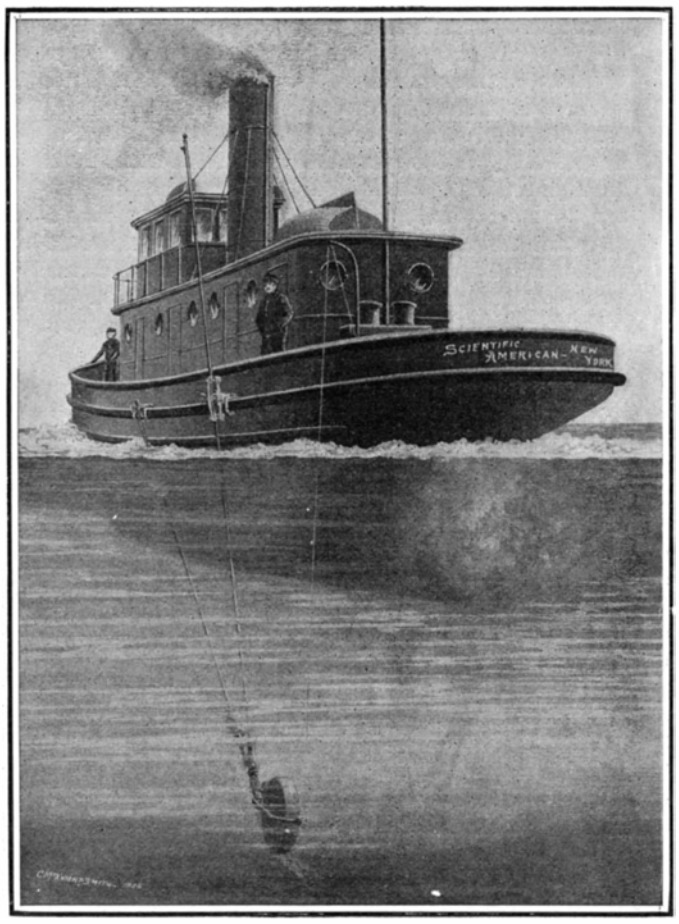
Dr. Vogel has published statistics, from which he estimates the consumption in Germany at about 22,000 tons, and the production of German factories at 9,800 tons, leaving more than 12,000 tons for importation. The countries from which this amount is principally drawn produce altogether the following quantities: Norway, 9,500 tons; Sweden, 8,200 tons; Switzerland, 21,000 tons; Austria-Hungary, 15,000. The European countries consuming the largest quantities are Germany, France, and Italy. He estimates the total consumption of Europe at 50,000 tons, and of the whole world at 100,000 tons.

A NOVEL PROFILE TRACER.

The surveying and charting of our navigable waterways and our coasts cannot be performed with too much accuracy or care. Marine disasters within the limits of surveyed areas are often attributed to uncharted dangers within these areas, shoals, or ledges, for instance, which have escaped detection through the weaknesses or inadequacy of the devices now used in charting the waters of coast and harbor. Hydrographic surveying consists of two operations, the measurement of the depth of the water at a certain point and the determination of the location of that point. The latter operation can be performed with absolute accuracy and to any degree of precision necessary with the present means at the command of the surveyor; but the former, the determination of the depth, is rarely absolute in its results. In addition to the inherent defects of leadline or rod, there is the uncertainty due to an insufficiency of the soundings to develop fully the relief of the bottom, for the cost and labor of the requisite number are often prohibitive.

A continuous sounding apparatus, illustrated in the accompanying engravings, has recently been designed by Mr. Swepson Earle, of Washington, and has been protected by patents in the United States, Great Britain, France, and Germany. The inventor has had varied experience in hydrographic surveying, and is familiar with all its requirements. The machine is simple in character, said to be efficient in operation, and has been favorably received by hydrographers both in this country and abroad. By means of this apparatus the relief of the bottom is obtained, not merely by the determination of a series of depth measurements necessarily a certain distance apart, but by the accurate and continuous registration of the outline or contour of the bottom. In addition to its use in general surveys of harbors, channels, anchorages, and all dredged areas, it should prove of value to pilots in connection with a guide launch or tug entering or leaving harbors in advance of the vessels of deeper draft.

The apparatus is decidedly simple in construction and operation. A long, inclined rod, attached by means of a swivel connection to the side of the vessel, forward, extends downward and aft to a wheel in contact with and rolling upon the bottom. Another rod extends upward from the wheel to the rail at the quarter, passing through a guide bracket pivotally secured to the side of the boat at the rail. The latter rod is graduated to show the depth of the water when the wheel rests upon the bottom. When not in use the apparatus can be raised by means of a rope attached to the axle of the contact wheel, and carried in a position substantially parallel with the side of the vessel. An automatic bell signal, operated by two projections on the wheel which actuate a connecting arm to the bell, gives audible evidence that the contacting member is rolling properly upon the bottom of the waterway. An automatic recording device, registering the outline of the bottom upon a moving roll of paper, is part of the complete machine, though not at all necessary to its successful operation, for the depth at any instant is easily read directly from the graduated rod as the vessel traverses the surface of the river or harbor under investigation.



A NOVEL PROFILE TRACER.

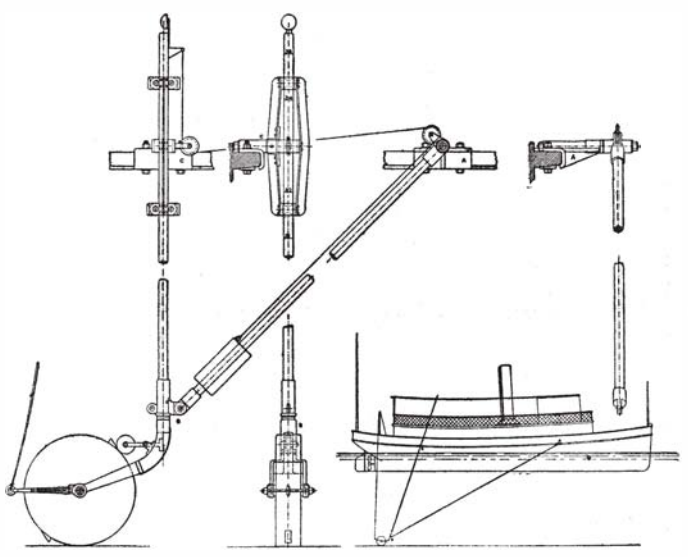
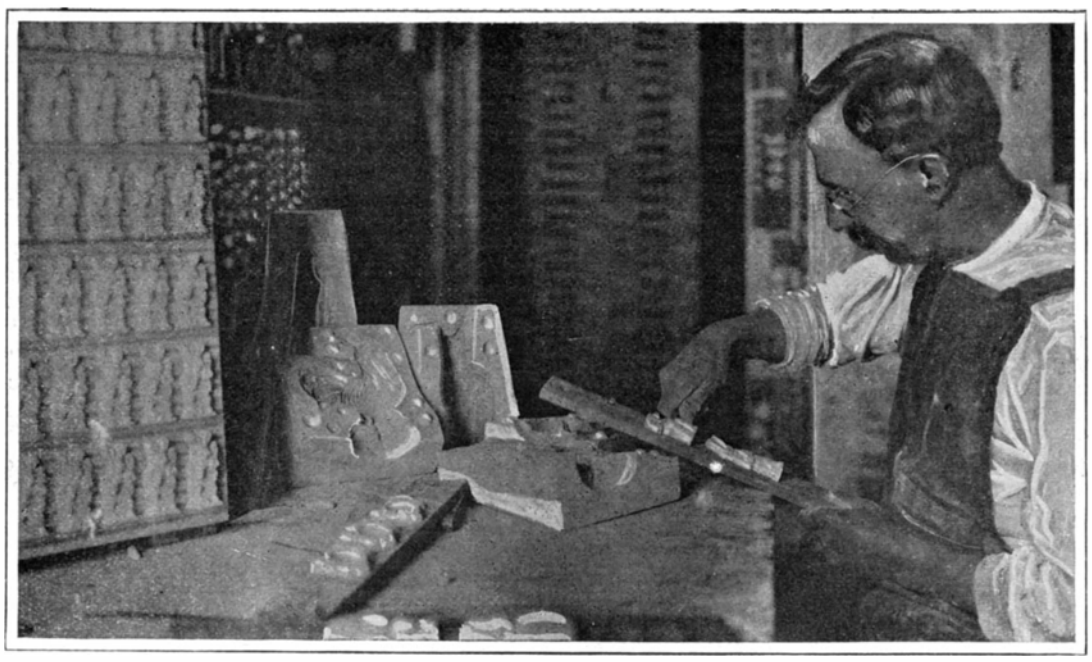


DIAGRAM OF PROFILE TRACER.

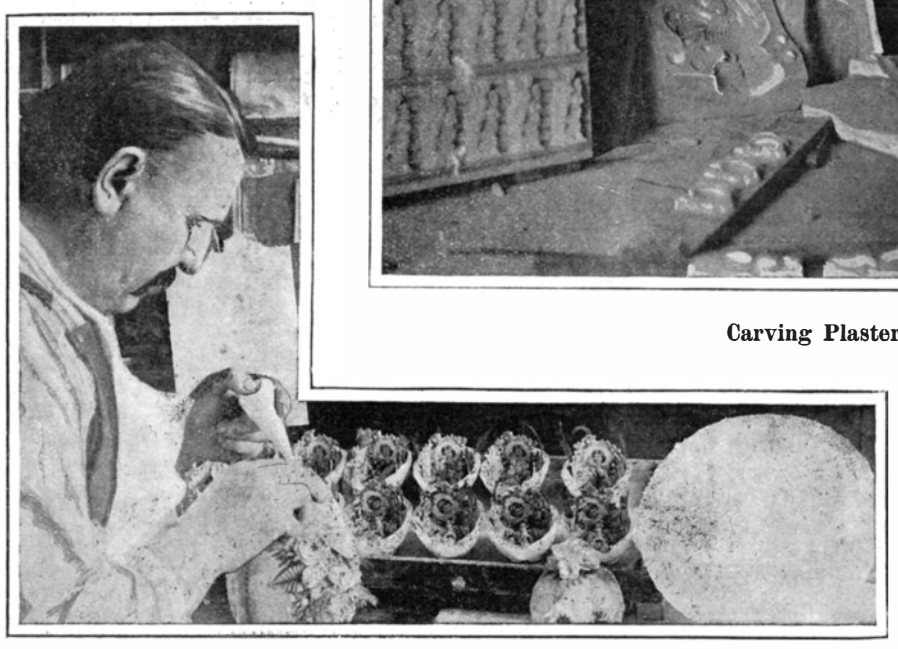
HOW EASTER EGGS ARE MADE BY THE THOUSAND.

A remarkable development of modern manufacturing activity is found in the numerous industries, some of astonishing magnitude, which have sprung from popular customs, often national, though more frequently religious—practices which, while almost universal in scope, were nevertheless formerly largely individual or personal in character. Thus to-day we have in the manufacture of valentines or of Christmas tree ornaments industries producing countless novelties, involving the expenditure of millions of dollars, and, notwithstanding the numerous forms of ingenious labor-saving machinery which their growth has developed, necessitating the employment of thousands of workers. To a large extent this is also true of the manufacture of Easter eggs and Easter novelties, an extensive industry partly embraced within the field of the confectioner, and which is illustrated in the accompanying engravings. It is not possible to describe in this limited sketch the methods of making the manifold Easter toys, such as the plaster rabbit, beloved of the youth of the land, or the ocher-colored chick, with its wobbly wire legs, and consequently we shall deal exclusively with the more or less edible—at any rate they are eaten—confectionery novelties.

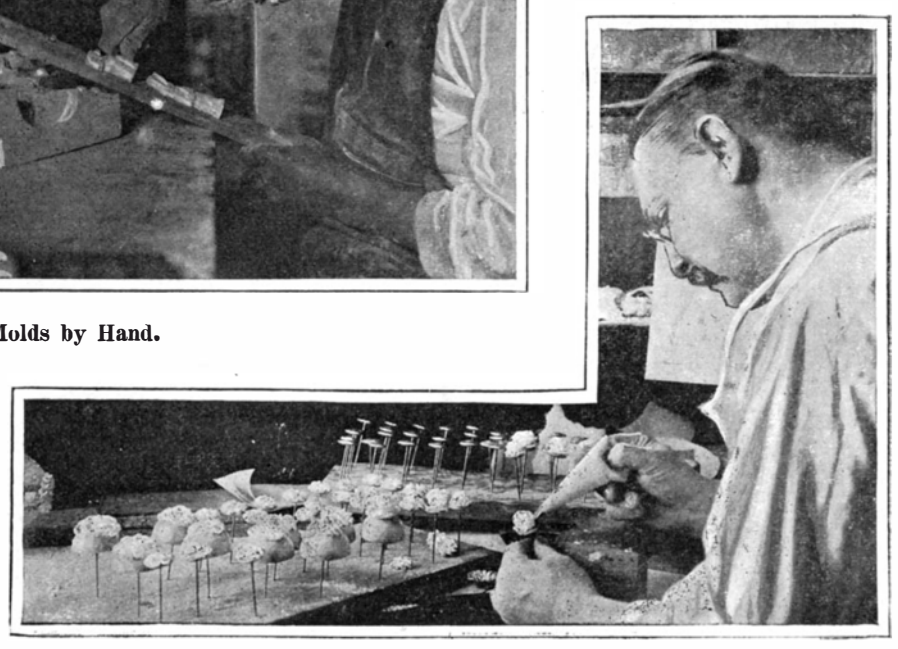
The major portion of those of marshmallow or other similar material is made in molds. The millions of little speckled and glossy eggs which each Easter reappear to the delight of the children, and it is to be feared, subsequently, that of the medical profession, are nothing more than somewhat glorified "jelly beans," a confection popular for the past twenty years. Molds for these eggs are made of plaster of Paris, and are placed in regular rows on printing boards to make impressions in powdered starch. A flat wooden form or open tray is filled with the starch, and placed in a machine underneath a heavy metal frame provided with a large number of these plaster of Paris molds. This frame descends upon the starch, is struck a few blows by a small trip-hammer, which is a part of the mechanism, and then rises, leaving in the starch a corresponding number of impressions from the molds. The tray is now inserted in another machine, which automatically drops into each depression the requisite amount of the jelly, and then the mold is set aside to allow this to harden. No upper mold is necessary for the small eggs, as in the cooling the upper portions contract and round off sufficiently to approximate an ovoid in form. The eggs are coated in great open revolving drums, into which from time to time melted or powdered sugar is poured, and where, as they are tumbled about, each gathers an even outside layer of smooth and glistening or crystalline character. The speckles of red, blue, or other colors are supplied in a simple manner. The eggs by the hundred are



Carving Plaster Molds by Hand.



Finishing Panorama Sugar Eggs.



Forming Flowers of Icing to be Used for Decorating Eggs.

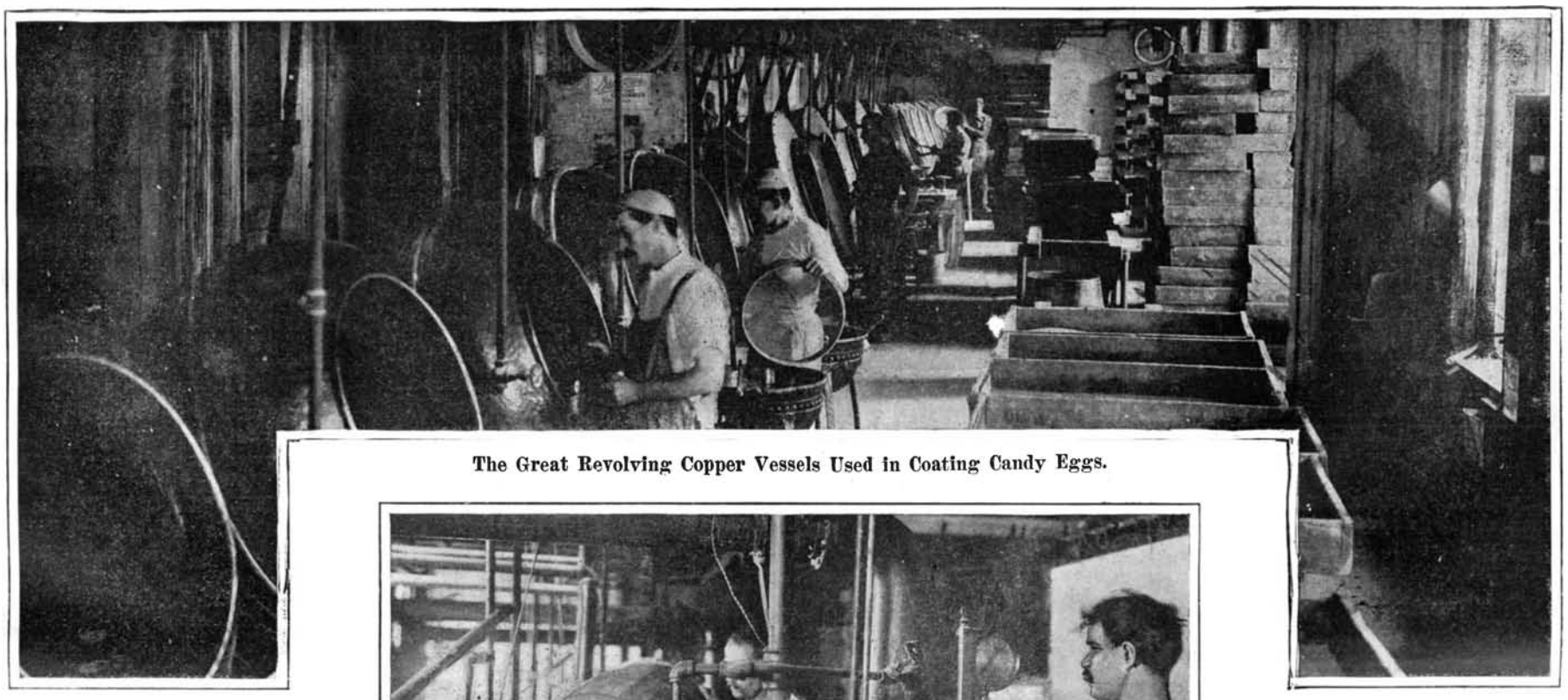
HOW EASTER EGGS ARE MADE BY THE THOUSAND.

spread upon tables, a stiff brush is dipped in the coloring liquid, and the latter is spattered upon the eggs by simply drawing the bristles back and then releasing them to spring into a normal position.

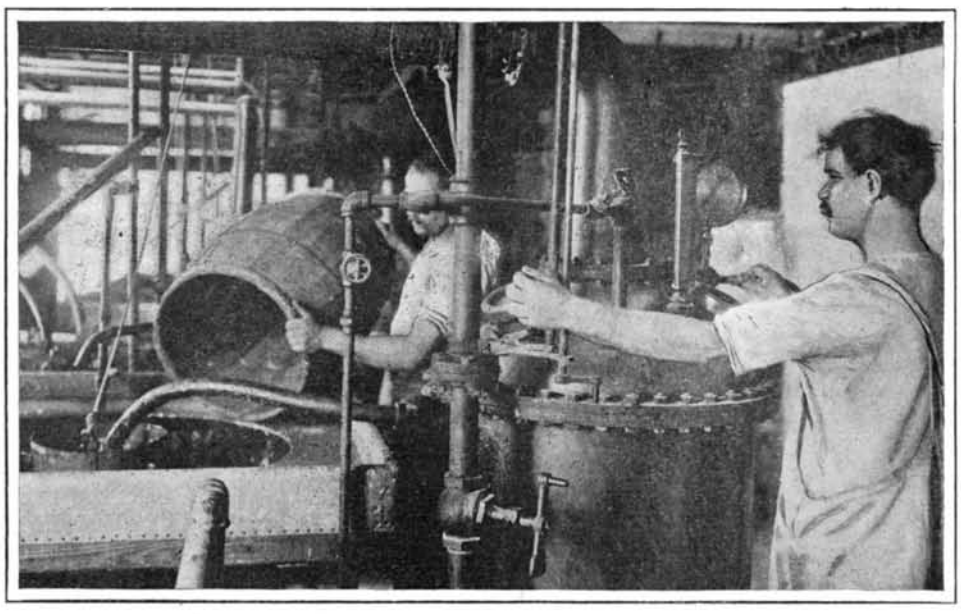
The plaster forms for the machine which impresses the molds into the starch are usually cut by hand, though more complicated ones may be cast in other molds. For the larger eggs or for more ambitious figures the molds are of course double, and are filled by hand by workmen who draw the material, usually marshmallow paste, from great stirring vessels into funnels. In each funnel is a rod, one end of which enters the spout and acts as a stopper until the workman raises it and allows a quantity sufficient to fill one of the molds to run out. The halves are allowed to harden, and are then cemented together by means of a sugar icing. The larger eggs are coated in the same manner as the smaller ones, while the figures, such as rabbits or chickens, are colored by hand.

are manufactured in an interesting manner. A plaster mold is used which has in the bottom an indentation, semi-ovoid in shape and of the size of half the egg to be formed. The mold is filled with a sugar solution, which when allowed to stand at the proper temperature, soon begins to form the beautiful crystals found in rock candy, on the sides of the mold and across the top. When the proper time has elapsed the crystal form is punctured, the remaining liquid drained off, and the sides and top broken away, leaving only the ovoid indentation, which becomes half the egg. This process is necessary, it will be understood, as the crystals are formed inwardly, and the outside of the form against the side of the mold is merely smooth and white. The edges of the semi-ovoid are then evened preparatory to joining two such halves by means of a sugar cement. Prior to this, however, the highly-colored and lithographed bits of paper, or other material constituting the scene in the interior of the egg, are placed in the lower half and cemented therein by means of a sugar icing. After the halves are joined, the bit of glass inserted in the peephole, and a paper or other band placed upon the joint running around the egg, the latter is ready to be decorated on the outside.

The decoration of these chocolate and sugar eggs is very largely a question of the skill of the workman, for the method itself is comparatively a simple one. The implement is a cornucopia provided with a nozzle through which the decorative substance, sugar paste, icing, etc., contained in the bag, may be pressed and applied to the object to be embellished. For certain classes of work these cornucopias are of rubber cloth, large in size and provided with a variety of nozzles which have openings of different kinds and number. The greater part of the delicate scrolls, figures, and flowers with which the eggs are decorated, is however applied by means of small parchment paper cornucopias with a pointed metal spout, and the dexterity and rapidity with which the complicated designs grow under the hands of the worker who uses nothing but this simple instrument, are remarkable. It almost appears as if the completed decoration were simply flowing from the nozzle, so quickly does the picture near completion. As shown in one of the photographs herewith, even the most delicate flowers, built upon separate standards and later transformed to the object which they are intended to grace, are formed in this manner, and it is easy to understand that for work of such character a steady hand, a clear perception of design and proportion, and years of experience are requisite.



The Great Revolving Copper Vessels Used in Coating Candy Eggs.



A Steam Cooker Used in Preparing the Candy.

Decorating Chocolate Eggs With Designs in Icing.

Finishing Small Marshmallow Chicks and Rabbits.

HOW EASTER EGGS ARE MADE BY THE THOUSAND

The solid chocolate eggs and figures are molded or pressed in metal forms. The hollow decorated eggs are formed by hand in heavy tin molds. The semi-plastic chocolate is placed on a table, and worked by means of a kind of paddle until it is of the proper temperature, when it is plastered by hand into the half mold, pared off across the edges of the form with a knife, and then allowed to harden for three or four hours, when it is easily squeezed out of the mold and is ready to be cemented to the other half to form the complete egg. No little skill and practice are requisite to enable the worker to line the sides of the mold with a layer of chocolate of just the right thickness and consistency, and upon these the success of the operation, to a large extent, depends.

The beautiful white crystalline sugar eggs, which have a little glass peephole at the point, and a gorgeous and highly-colored scene or panorama on the inside,

The Sense of Smell in Snails.

Emil Jung, a professor in the University of Geneva, after diligent investigation and study, announces that snails perceive the odor of many substances, but only when not far away.

In order to prove this interesting fact it is necessary merely to dip a glass rod in a strongly smelling substance, as for instance the essence of chamomile, and bring it near the large tentacles of a snail in motion. If it is put close to these horns, the tentacles are violently drawn back. As the animal perceives the odor, it changes its course. Snails also smell by means of their skin. Contact is not necessary, for the mere vicinity of a perfume causes an indentation of the skin. Jung has endeavored to ascertain at what distances snails perceive odors. He has put various articles of food, such as cheese, potatoes, cabbages, etc., at varying distances from twelve snails, and has discovered that they perceive the odor of most foods at a distance of about three centimeters, but that of melons at an exceptional distance, namely, half a yard away

THE INUNDATION OF THE SALTON BASIN BY THE COLORADO RIVER AND HOW IT WAS CAUSED.

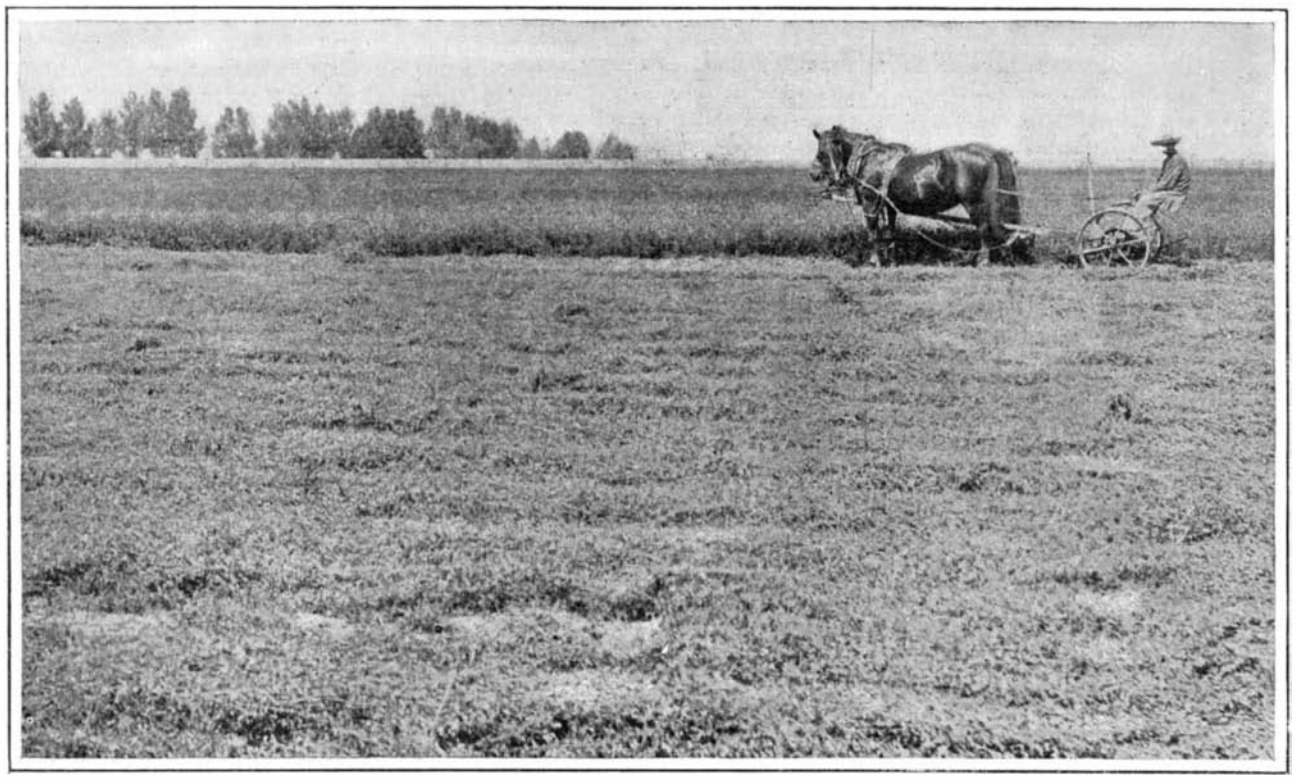
BY ALLEN DAY.

If the Colorado River continues to flow through the channel which it has been occupying during the last six months, the geography of the Southwest must be radically changed, for at the present time but little water from the river reaches the Gulf of California, which until recently has formed its main estuary. Except when the river is in flood, the bulk of the water flows into what is known as the Salton Sink in southern California—a distance of fully 160 miles from the gulf. The new channel of the Colorado takes a northwesterly course, while the channel it formerly occupied is nearly south.

It is perhaps needless to say that this watercourse is not only one of the most important in the Southwest, but is notable for the immense volume of water which it carries, especially during the flood seasons. But the quantity of detritus which it holds in solution is enormous, and is nearly equal to that carried down by the Mississippi at certain seasons of the year, owing to the topography of the region which drains into it. An idea of the quantity of water carried by the Colorado at different times of the year can be gained, when it is stated that actual measurements indicate a flow ranging as high as 30,000 cubic feet per second. It is estimated that if the silt and other material brought down the river in the course of a year were spread evenly over a given surface, it would cover no less than 35,000 acres to a minimum depth of one foot. Consequently, the Colorado is almost as much of a "land maker" as the Mississippi, acting like a gigantic suction dredge in carrying away the material in its vicinity and depositing it upon the lowlands near its mouth and in the Gulf of California.

It is a well-known fact that the Sink, as well as the desert around it, was once a portion of an ocean bed, as is shown by the remains of marine animals as well as the immense deposits of salt. Readers of the SCIENTIFIC AMERICAN are aware that these deposits have created an important industry in southern California, the salt being secured from the surface by plowing and then carried away by the carload.

The Salton Sink or basin is the name given to that part of the Colorado desert that is below sea level. As shown on the accompanying map, this area begins a little north of Indio, on the main line of the Southern Pacific, and extends in a southeasterly direction, generally widening out until it passes Old Beach or Imperial Junction, leaves the railway to the east and extends south away down to a point near Signal Moun-

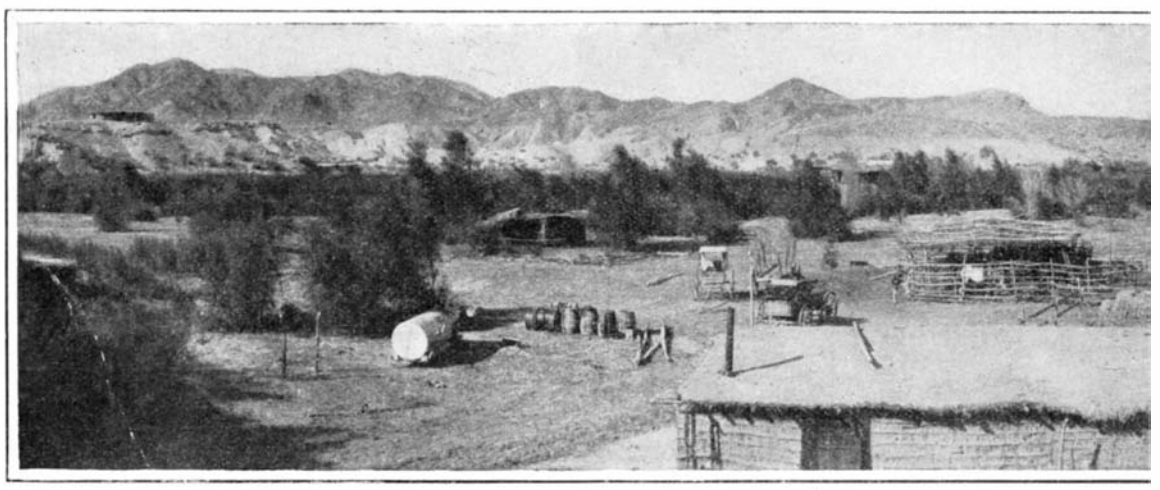


Alfalfa Growing in the Former Desert After Irrigation

The Arid Sandy Waste of the Imperial Valle

One of the Canals Fed by the Waters of the Colorado.

A Corn Field After Irrigation, Showing One of the Irrigation Ditches.

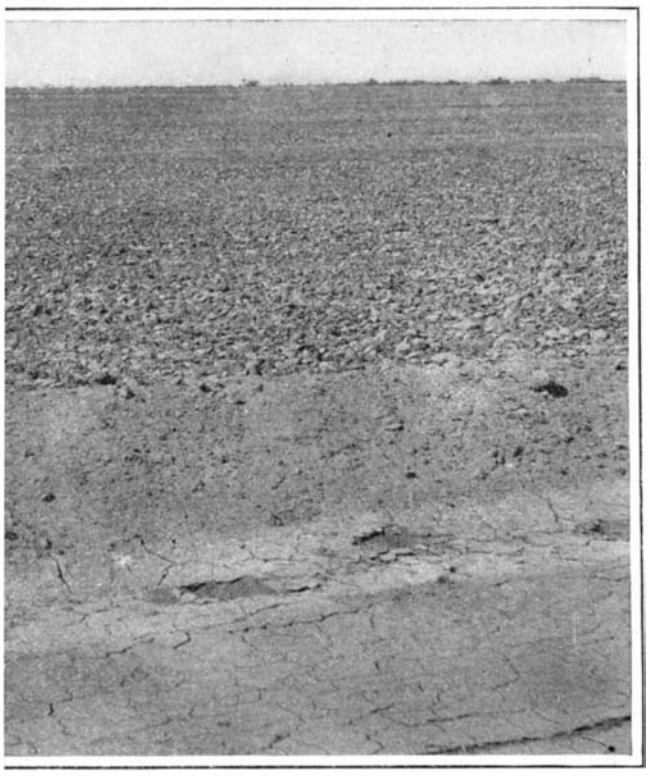


Section of the Imperial Canal Which Caused the Ove

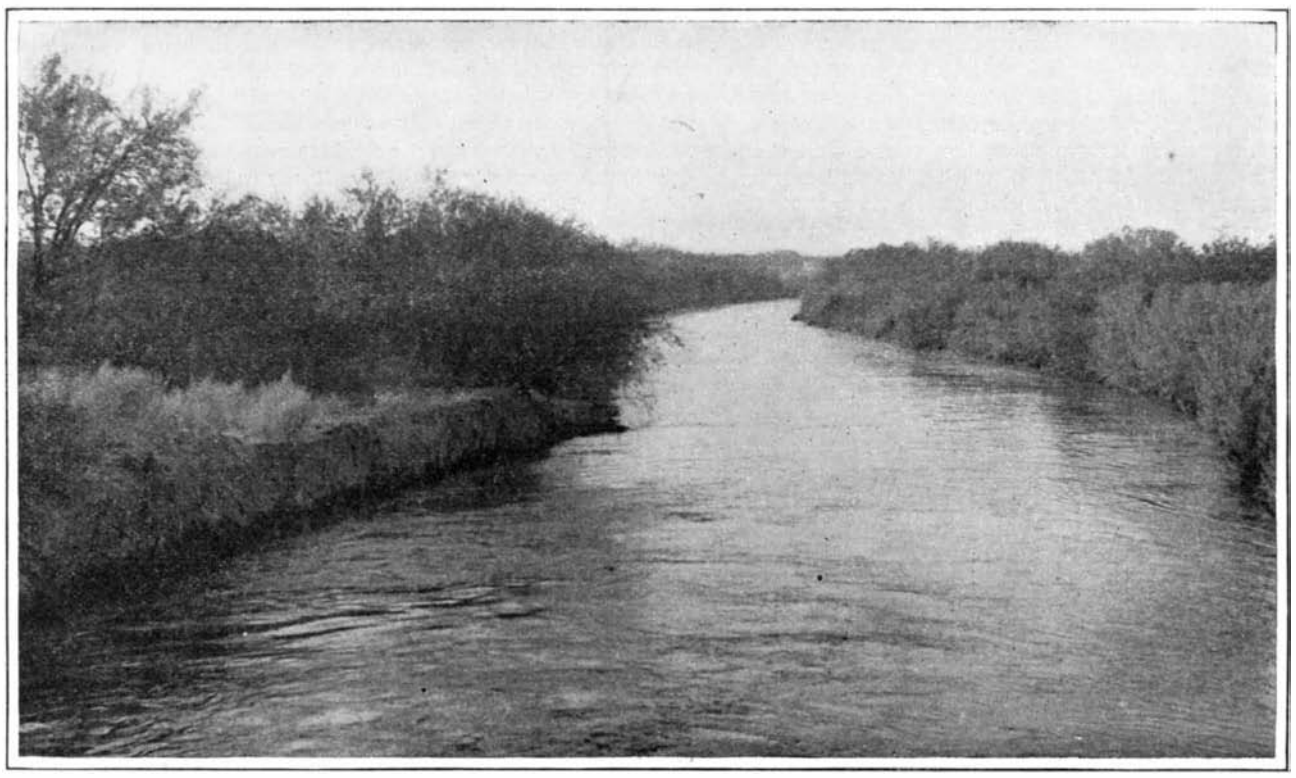
The Inland Sea Spreadi

tain, which is across the boundary in Mexico. This basin is surrounded by mountains on three sides, and is limited on the south by sedimentary deposits of the delta of the Colorado River which have piled up 40 feet above sea level. It was undoubtedly, within a comparatively recent time, a portion of the Gulf of California, which then extended farther north than it does now. The Colorado River, at that period, emptied into the Gulf at about where Yuma now stands.

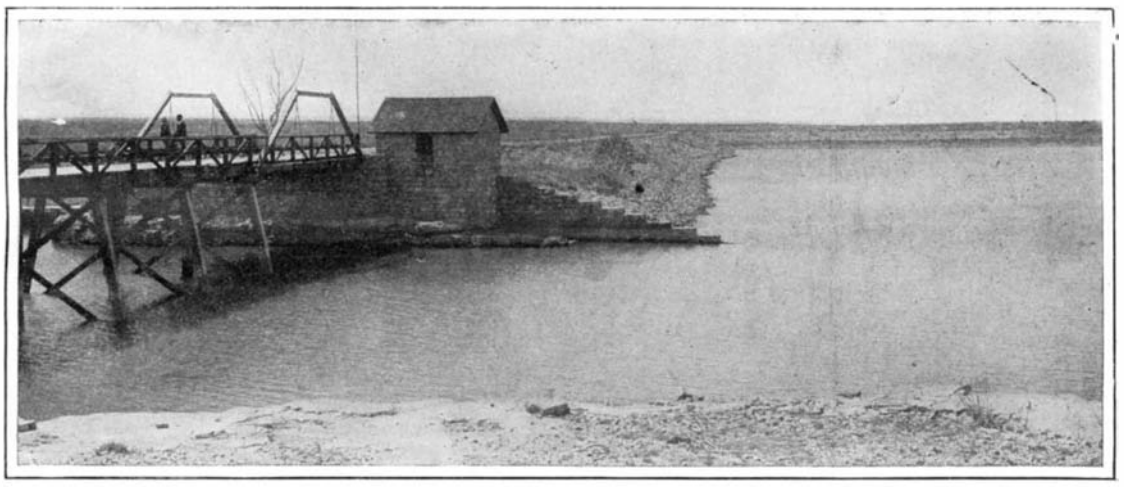
In the latter part of May and throughout June and part of July of each year the melting snows of the far-away mountains send a raging torrent through the canyons and out into the more level plain of the Colorado. Overflows at such times are not uncommon, and, at Algodones, in Mexico, some dozen miles below Yuma, it is an almost annual occurrence for the river to overflow its banks. This overflow finds three channels for its distribution, some of it entering the bed of an ancient river, known to the Mexicans as the Alamo, and flowing westward for some forty to fifty miles, then turning north for over fifty miles, where it emptied into the Salton Sink. Another portion went by devious channels and also by way of the Rio Padrones into Volcano Lake, where a strange separation of the water takes place. Some portion of it flows north by way of a channel recently called New River to Salton, while the remainder flows south by Hardy's



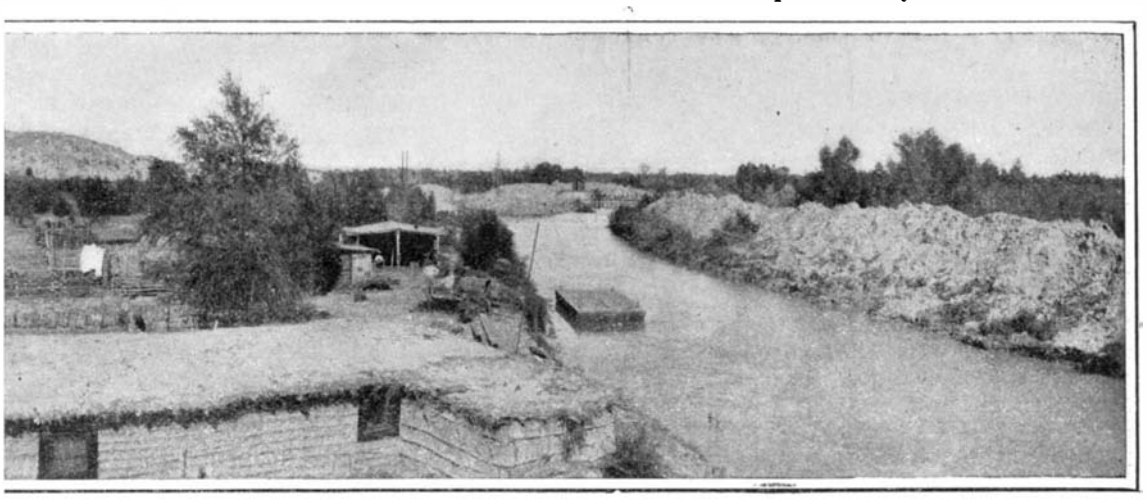
y Before the Colorado Burst Its Barriers.



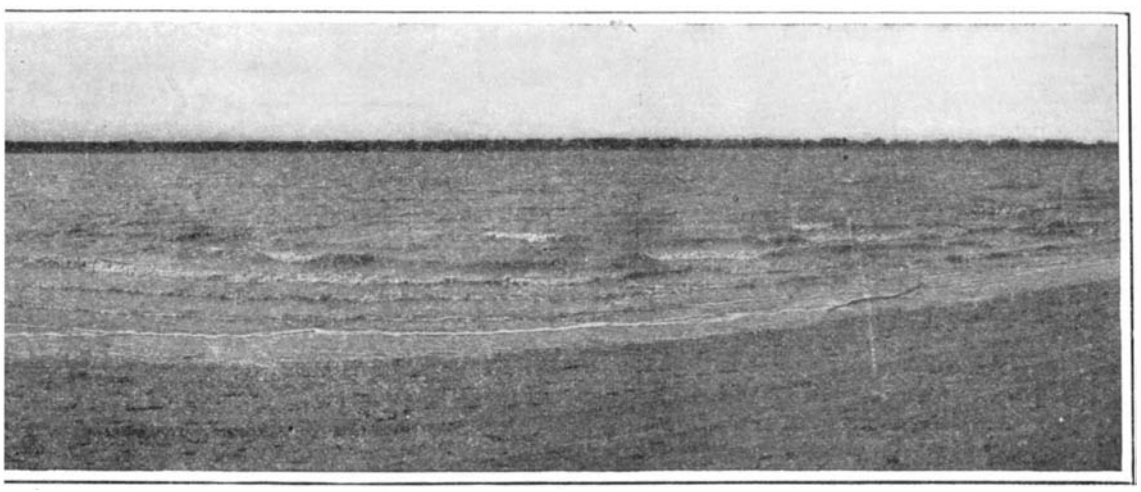
A Watercourse by Which the Colorado is Flowing upon the Desert. Vegetation Has Grown Along Its Banks.



A Section of One of the Reservoirs in Imperial Valley.



erflow. Also a Ranch on the Reclaimed Territory.

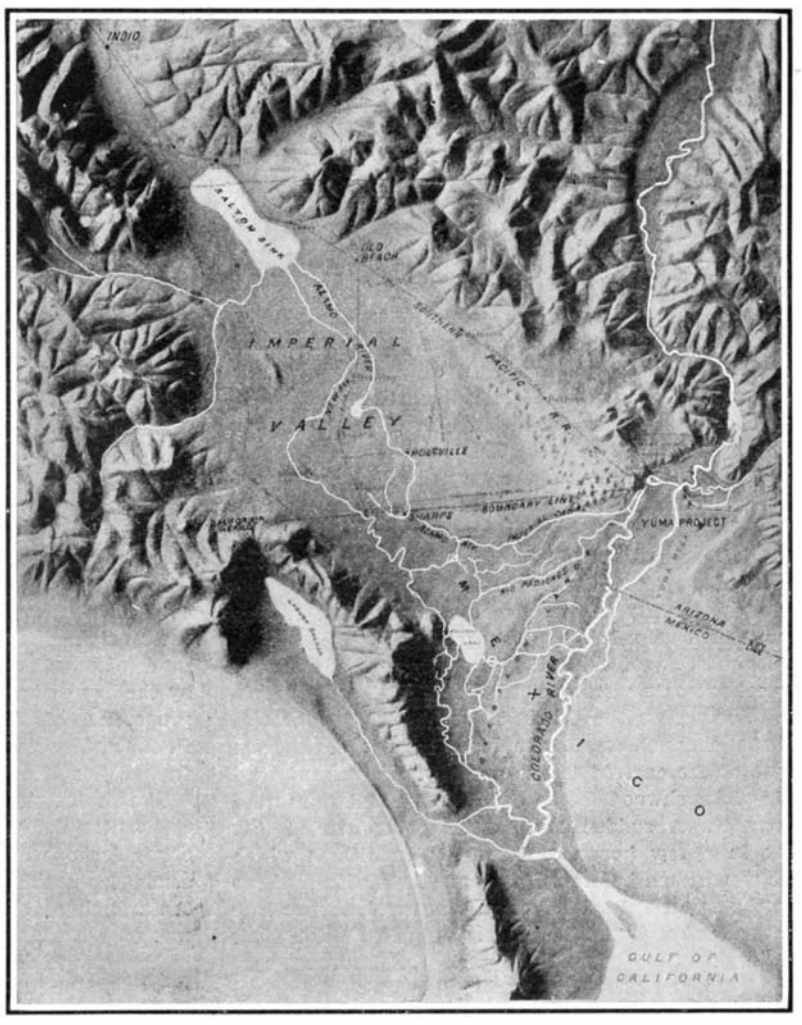


g Out Upon the Desert.

River to the Gulf. The water thus emptied into the Salton Basin was subjected to the evaporative processes of the sun and a Saharan atmosphere, so that it speedily disappeared, leaving the bed practically dry until the floods of another year sent in a fresh supply of water.

With the view of reclaiming a portion of the Colorado desert, as it is called, by means of an irrigation system, a company began operations in 1901, taking advantage of the channel of the Alamo River to excavate what is known as the Imperial canal system. About ten miles of the river channel were dredged out, and connected with a series of waterways extending over an area embracing about 100,000 acres. A portion of the irrigated territory is in Mexico and the balance in southern California. The extent and variety of the crops induced the settlement of this region on such a scale that at present about 12,000 people are residing in the villages and upon the irrigated farms, while the Southern Pacific Railroad has constructed a branch line through the territory. A description of the Imperial Valley, which represents perhaps the most notable reclamation work yet undertaken in the United States, recently appeared in the SCIENTIFIC AMERICAN.

Unfortunately, the diversion of the water into the canal was checked



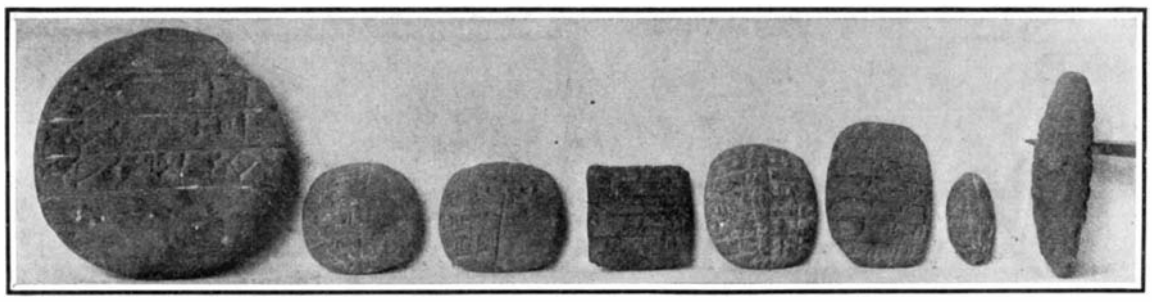
The Imperial Valley, the Colorado River, and the Inundated Country.

C COLORADO RIVER AND HOW IT WAS CAUSED.

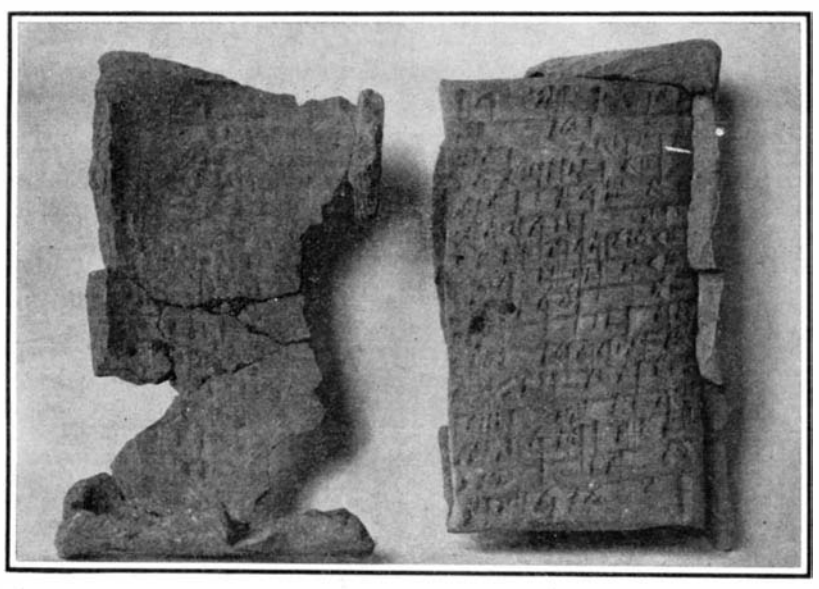
to such an extent by the accumulation of detritus at the head of the canal that the irrigation company determined to secure another supply rather than go to the enormous expense of dredging the clogged canal head. With this idea in view, they excavated a channel a few miles below the head of the Alamo channel, connecting it with the Colorado. This work was completed in November, 1904. The excavation was merely a ditch less than a mile in length and about fifty feet in width, but a flood which occurred a few weeks after it was completed enlarged it to such an extent, that a considerable volume of the water in the river began flowing through it into the main canal. The flow of water was too great to be absorbed by the irrigation system, and as already stated, it worked its way along the lower Alamo channel to the Salton Sink, into which it is still flowing. Owing to the friable formation of the river banks at the head of the new channel, and the force of the current during flood season, it was found impossible to prevent the ditch from being enlarged to such an extent that within six months after the first crevasse occurred, nearly all of the water in the Colorado was being diverted in a northwesterly course into the Sink.

The greatest volume of water in the river is usually during the months of June and July, when the drainage from the mountains along the upper river and its tributaries is greatly increased by the melting snow and ice. Measurements taken by engineers in July last showed that no less than 25,000 cubic feet per second were flowing through the new channel. Since then there have been times when the river bed between the channel and the Gulf of California has been practically dry, except when the river was abnormally high. The effect of the current aided by the erosion of the sediment held in solution enlarged the new channel from its original dimensions to a width varying from 600 to no less than 2,000 feet in some places, and considerably deepening it. As a result, the water contained in the Salton Sink has been steadily increasing, until fears have been entertained lest the entire valley between the San Jacinto and San Bernardino mountains, which inclose the Sink on three sides, will be flooded. Recent measurements of this new sea which is forming show that it is at present about 50 miles in length, having a maximum depth of about 25 feet. The daily increase in depth varies of course according to the quantity coming down the river, but it has been as high as nearly three inches in twenty-four hours, varying from this to three-fourths of an inch. While the salt industry has been practically ruined by the flood, as yet the irrigated district has not been harmed, owing to its elevation. The basin must be filled to a maximum depth of at least 150 feet before the water would cover the farms of the Imperial Valley. Consequently a period of years would elapse before the irrigation district would be affected; but the heaviest loss is that of the Southern Pacific Railroad, for it has been compelled to alter the location of its roadbed, and rebuild about fifty miles of track at a greater elevation to prevent it from being submerged.

The question of confining the river to its ordinary channel presents a somewhat difficult engineering problem. Soon after the Colorado began flowing through the new channel, an attempt was made to change the course of the current to the south by a diverting wall made of brushwood fastened with wire and reinforced by gravel. A sudden rise in the river carried this away in a few hours, and created conditions which were worse than before. An attempt was also made to lead the water into the Padrones channel, thence into Volcano Lake, but this was unsuccessful, the river forming another channel between the Padrones and the Alamo and continuing on to the Sink. The final plan determined upon, which is now being carried out, is the construction of two massive barriers, one protecting the head of the original channel, and the other the head of the channel through which the river has changed its course. The first barrier, which will be 175 feet in length, is being built of concrete and steel on a rock foundation, and contains head gates which will allow a sufficient volume of water to flow into the canal for irrigation purposes if desired. The lower work is about 200 feet in length, also composed of concrete and steel, but is being constructed in connection with wing dams and levees of timber and earth. This is also provided with gates. The concrete and steel portion of the barrier is being built at such an angle that it will offer the principal resistance to the flood currents, while the dams and levees are intended to prevent the bank from being washed away by eddies or other back water. It is expected that the two barriers will be completed before the summer floods reach the lower river, the engineers working partly on the theory that the mass of silt which will be carried down at this time will tend to scour out the original channel, and aid in confining the volume of water. In short, the principle is the same as has been so successfully employed in the deepening of the Mississippi near its mouth by the construction of the jetties, the river partly making its own channel. Since the Colorado has been flowing into the northwest passage, its former bed has been steadily filling up by the accumulation of sediment in the vicinity of the cut-off. If the flood currents remove this deposit, it is believed that the work which is now being done will permanently keep the river in its original course, and prevent further flooding of the valley to the northwest. A more complete account of the dams which are now in course of construction, and which are intended to control the Colorado River, will appear in next week's Scientific American.



School-boy exercise tablet. | Spherical tablet. | Corners begin to appear. | The tablet has become square. | Less oval. | An oval tablet. | Tag of clay. | Plano-convex tablet.



A Babylonian "Case Tablet" or clay letter with its envelope broken and half removed.

A letter and its envelope. The letter shows beneath the broken portion of the envelope.

LETTER WRITING FIVE THOUSAND YEARS AGO.

BY EDGAR JAMES BANKS.

While Babylonian clay tablets of various forms and sizes have been known and collected by the large European museums for fully half a century, it is only in recent years that tablets of an exceedingly ancient date have been found in sufficient numbers to reveal their origin and early development. Of the two thousand tablets discovered in the Babylonian ruin Bismya by the expedition of the University of Chicago, a large proportion of them date from the fifth millennium B. C., and present such a variety of shapes and sizes that their origin has for the first time been ascertained.

The first Babylonian tablets, and therefore the oldest written documents in the world, were of clay. The original shape was round like a ball, and in size it resembled a small orange. The early scribe drew upon the soft clay the rough pictures by which his language was expressed, and then placed the written document in the sun to dry. As writing became more common, the tablet lost its spherical shape and the inscription was confined to its flattened sides. A number of such tablets, almost spherical, came from Bismya. As the centuries passed, the sides became flatter, corners began to appear in the circular edge, and by 4000 B. C. the tablet suggested the square into which it soon developed.

Side by side with the evolution of the square tablet from the clay ball, a similar tablet was developed from the early building brick. The first Babylonian brick was rectangular; its sides were plano-convex—plane on the bottom where it rested upon the ground to dry, and convex on the surface, because while drying the edges ran down the sides. To the first tablets which were not spherical or nearly so, this plano-convex form was imparted, but the convex side became less convex, and by 3800 B. C. both sides were nearly alike, and its form became identical with the tablets which developed from the clay ball. The tablet, square or nearly so, retained its shape for a considerable period; but if the inscription to be recorded upon it was long, the length of the tablet was increased, while its width remained practically the same. This elongated form of the square tablet thus became the standard for all of the later ages of the Babylonian empire.

In size the tablets vary exceedingly. While some measure hardly more than half an inch in length, others are fully eighteen inches long and a foot wide, yet the average of the hundreds of thousands of Babylonian tablets which are now in the museums of Europe may be not far from three inches in length and half as wide.

Although the rectangular form of the clay document prevailed, other shapes were adopted for special purposes as occasion demanded. The schoolboy's exercise tablet was invariably round, and the clay labels which were attached to merchandise were egg-shaped and their longer diameters were pierced with a hole for the string. An exceedingly interesting form of tablet was that given to the Babylonian letter of 2400 B. C. and later. The clay of the letter was molded and inscribed as were the ordinary business documents, and when finished, a thin coating of clay was wrapped about it, serving as an envelope to protect the writing within, or to conceal it from the eyes of the curious. The envelope was then stamped with the seal of the writer, or sometimes engraved with a few words, and the letter with its envelope was placed in the sun to dry, or in the furnace for baking. It was then ready for delivery.

The discovery of these early documents at Bismya has not only revealed the original form of the tablets, but has also assisted in explaining the development of the cuneiform or wedge-shaped writing. How does it happen that the Babylonians committed their thoughts to writing by stamping combinations of wedges upon clay? The wedge is an accidental result of the use of clay. The very earliest inscriptions, found mostly upon stone vase fragments, are not composed of wedges, but of straight lines. The Babylonians first wrote by drawing pictures of the objects which were in their minds. In time the pictures became conventionalized, as is the case with Chinese, and the original objects could no longer be recognized. When clay was substituted for stone, it was difficult to draw an even straight line upon it, for the edge of the style which first touched the clay sank deeper, leaving a wedge-shaped impression. The wedge thus arose; and as clay was practically the only material employed by the scribe, the wedge became so thoroughly identified with the language, and the old linear writing was so entirely forgotten, that during the last three millenniums of the Babylonian empire, the scribes, even when engraving upon stone, gave their characters a wedge-shaped form.

An engineering firm at Pittsburg has patented a new type of universal plate mill, and has received a contract from the Illinois Steel Company for the building of one of these mills at South Chicago. The mill will be driven by an electric motor of 6,000 to 8,000 horsepower capacity, this being the first time that a mill of this character and size has been electrically driven.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

SPEED-INDICATOR.—G. IHLE, 4 Alexandrinenstrasse, Berlin, Germany. The object of this inventor is to make an improvement in speed-indicators with magnets and indicating members rotating around the same axis. The indicating member, which is connected in the usual manner with the indicating mechanism, consists of a hollow body and is inclosed upon the greater part of its periphery by the rotated magnet system, an iron core which rotates with the system of magnets extending into this hollow indicating member. This makes it possible to employ a system of magnets forming a considerable mass as it is driven, while the hollow indicating member may be of exceedingly small mass.

Of Interest to Farmers.

ALARM.—H. IRWIN, Fern Hill, Hawkes Bay, New Zealand. The invention relates to alarms, and more particularly to those adapted to serve as scarecrows. Its principal object is to provide an efficient apparatus by which a series of explosions may be produced at definite intervals for the purpose of frightening birds or animals away from trees, crops, and the like.

BEET-CULTIVATOR.—O. SORENSON, Fowler, Col. This implement may be conveniently attached to a sulky. To the axle draw-bars are attached, which extend rearwardly and carry handles. The rear end of these bars are formed into forks to which brackets are pivotally attached, the latter formed integral with special saddle-plates. Opposite these plates are two saddle-plates, and these are connected by special bolts with the first named plates, affording means for clamping the forward beam. As the implement passes once across a field it cultivates two or the equivalent of two rows.

FEEDING DEVICE FOR POULTRY.—H. P. NOTTAGE, Goshen, Mass. In use the feed gravitates, and the finer particles are precipitated from the three compartments of the box through the meshes of the screen which covers the opening leading from one to another compartment therefor in the trough. Poultry picking at the feed through the screen causes it to be loosened up so as to be continuously supplied to the several compartments of the trough. The openings permit poultry to project their bills so as to pick feed from out of the compartments and by the presence of the screen wires or bars, they cannot throw or scatter feed in any attempt to throw their bills from one side or the other.

Of General Interest.

ADJUSTING DEVICE FOR PRINTING-BLOCKS.—W. H. WALDRON, New Brunswick, N. J. Printing-blocks with which linoleum-printing machines are supplied are of considerable length, and apt to bend, so that parts of the printing-surface are impressed with too much force upon the fabric and other parts are either impressed too lightly or do not print. The object in this case is to provide means for adjusting the printing-block so that the several parts thereof can be forced outwardly or inwardly in order to overcome defects due to bending and to present an even printing-surface.

AUTOMATIC FEED DEVICE. — E. J. ERICSSON, San Francisco, Cal. The invention relates to water distribution; and its object is to provide a new and improved automatic feed device for supplying water to flush-tanks, leader-traps, surface drains, and similar contrivances, and the water-supply of which is not sufficiently regular to maintain a permanent seal, as required by modern sanitary plumbing.

BOBBIN.—C. C. COST, Bismarck, N. D. One of the principal objects of the inventor is to provide a bobbin by the use of which the necessity of unwinding the same is obviated, thereby dispensing with the use of balling-machines, as well as labor attendant thereupon. A further object is to provide a bobbin by the use of which the twine may in the first instance (as it is spun or manufactured from the fiber) be wound directly into form for baling.

Household Utilities.

CLOSET-TANK.—W. C. A. VISSING, JR., Salt Lake City, Utah. Closet-tanks as now constructed consist of several parts, sometimes containing as many as thirty or more. There are many chances of their getting out of order, and when the float is broken or fails to work they are likely to overflow, thus causing damage. On account of the large number of parts the cost of manufacture is high, as well as cost of maintenance. The washers frequently leak and have to be replaced. This invention is for the purpose of simplifying, cheapening and otherwise improving devices of this character.

SCRUBBING DEVICE.—H. E. H. ARMANN, Gardar, N. D. The invention pertains to a device for brushing and scrubbing. It is especially applicable for use upon floors, but is not strictly limited thereto. The invention comprises a brush, a mop, means for applying water to the mop and to the floor, and means for wringing the mop.

Machines and Mechanical Devices.

MACHINE FOR PRINTING AND ISSUING RAILWAY-TICKETS.—R. T. PISCICELLI, Piazza della Borsa, No. 22, Naples, Italy. Tickets printed may be either for predetermined or other stations. The machine prints: the name of the issuing station; the station for which ticket is issued; the date of issue; the number; the class and kind of tickets; the price; the number of the train; and information, advertisements, etc., on the back. While issuing a ticket, it adds money received; adds the number of each kind of ticket (single, return, express, or ordinary trains, &c.) issued; adds total number of tickets issued; and prints on a continuous paper ribbon a duplicate of matter printed on each ticket.

HOISTING AND CONVEYING APPARATUS.—C. J. HORGEN, New York, N. Y. This patentee's invention relates to a device for hoisting and conveying purposes in general, and is especially applicable to loading and unloading ships. It comprises a cable or similar flexible element placed on an incline and a carriage mounted on the cable and adapted to move along it, the carriage being provided with automatic means for manipulating a pulley to assist in the several operations of loading and unloading.

Designs.

DESIGN FOR A ROSARY.—H. F. NEHR, New York, N. Y. The ornamental effect secured by this designer is made neat and chaste. The junction of the loop and pendant is made by a heart shaped medal containing a head of Christ. A plain and well proportioned crucifix is at the usual end of the rosary.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8006.—For manufacturers of novelties and specialties.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 8007.—For manufacturers of street cleaning or street sweeping machines.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 8008.—For manufacturers of composite wire for making watch chains.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8009.—Wanted, address of any company which treats on the subject of "Expanded Metal" and also address of some gas-producing company whose outfit would not exceed four or five thousand dollars.

I have for sale the U. S. and all foreign rights of new patent Improvements in Water Tube Types of Boilers. Great economizer. J. M. Colman, Everett, Wash.

Inquiry No. 8010.—For manufacturers of egg separators.

PATENTS.—European Rights. I want sole agency for Europe for good-selling patents, or might buy rights. James R. Moodie, 73 Inverleith Row, Edinb'gh, Scotl'd.

Inquiry No. 8011.—Wanted, address of parties who install galvanizing plants.

Well gotten up typewritten letters will increase your business. $2 per 1,000.

Typewritten Letter Co., St. Louis.

Inquiry No. 8012.—For manufacturers of machines for scoring scale on rulers.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 8013.—For manufacturers of bench plane handles and stocks.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools, and wood fiber products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8014.—For manufacturers of street sweepers.

FOR SALE.—One Shafer Hydraulic Platen Press. 60 tons pressure, 18 inches platen with a 12-inch movement of ram; complete, with pump belt drive, lock-up pressure and safety valve. Vacuo-Static Carbon Co., Mill and Platt Sts., Rochester, N. Y.

Inquiry No. 8015.—For manufacturers of fire extinguishers.

FOR SALE.—At Taunton, Mass., patterns, patents, drawings; 4 to 25 horse-power gas or oil engines. Ten years test. Can furnish sample. Hadwen Swain Mfg. Co., 505 Sacramento St., San Francisco., Cal.

Inquiry No. 8016.—For manufacturers of chains for weight clocks.

FOR SALE.—Patent rights for United States on three illustrated post card novelties. If interested send 50c for samples. W. Becker, Jeffersonville, N. Y.

Inquiry No. 8017.—Wanted, address of parties who can give the most modern method of condensing or extracting water from sweet skimmed milk.

Inquiry No. 8018.—Wanted, address of makers of gas producer plants suitable for cooking, heating and lighting ordinary dwellings.

Inquiry No. 8019.—For manufacturers of Squeezre's easy floor cleaner or mop.

Inquiry No. 8020.—Wanted, address of parties making Brandt's kerosene pumps, tin piercing

Inquiry No. 8021.—For manufacturers of machinery and apparatus for the manufacture of liquid carbonic gas.

Inquiry No. 8022.—For manufacturers of decorticating machines for jute fiber.

Inquiry No. 8023.—Wanted, manufacturers to make connecting fittings for wagon tongs and neck yokes consisting of castings and ball bearing pivot.

Inquiry No. 8024.—For manufacturers of a machine for rolling and gluing paper funnels or cornucopias.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9941) A. J. C. asks how to polish German silver. A. Take 1 pound peroxide of iron, pure, and put half of it into a wash basin, pouring on water, and keeping it stirred until the basin is nearly full. While the water and crocus are in slow motion, pour off, leaving grit at the bottom. Repeat this a second time, pouring off into another basin. Cleanse out grit, and do the same with the other half. When the second lot is poured off, the crocus in the first will have settled to the bottom; pour off the water gently, take out the powder, dry it, and put both when washed clear of grit, and dried, into a box into which dust cannot get. If the silver work is very dirty, rub the mixture of powder and oil on with the fingers, and then it will be known if any grit is on the work. If the work is not very black, take a piece of soft chamois leather, and rub some dry crocus on, and when well rubbed, shake out the leather, and let the powder fall off that is not used, or rub it off with a brush. Do not put down the leather in the dust.

(9942) P. E. M. asks how to remedy a warped pole. A. Wet the concave side, and then hold the convex side to the fire.

(9943) J. V. B. says: Is it a scientific fact that when a fluid issues from an orifice, a rectangular aperture for example, the flow, which just after issuing is rectangular in section like the hole, twists about so that a short distance from the orifice the section is a rectangle having its corresponding sides at right angles to those of the hole? A. It is a fact that a fluid, issuing from a rectangular orifice, twists about in position as you describe. This is due to the fact that fluid rushing through the corners of the rectangular orifice tends to flatten out after leaving the orifice, while that part of the fluid coming through at the sides tends to bulge, thus giving the effect of apparently twisting in the flow. We have no SUPPLEMENT articles with regard to this matter, and we know of no published data on the subject.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE

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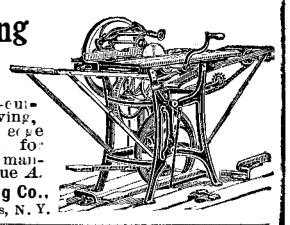

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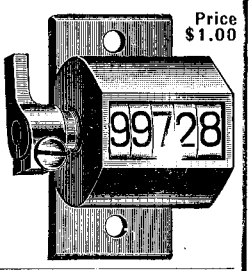

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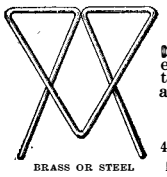

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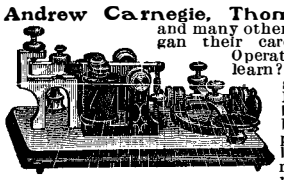

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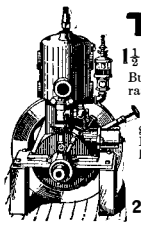

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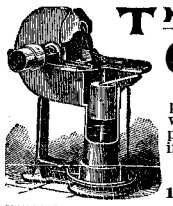

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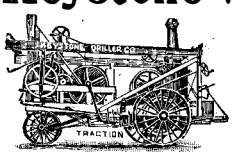

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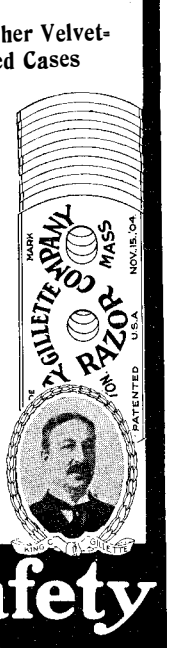

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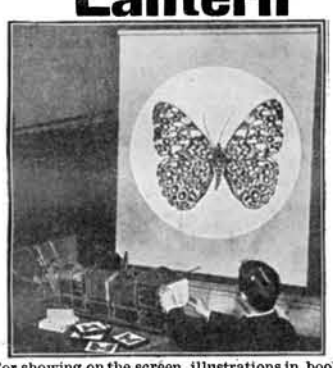

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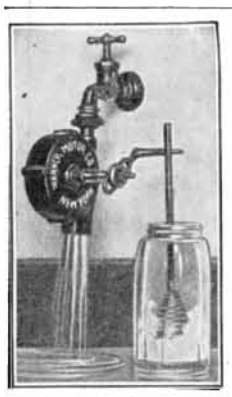

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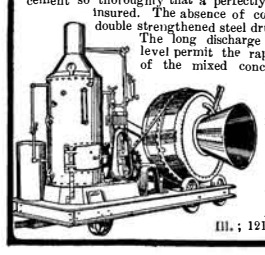

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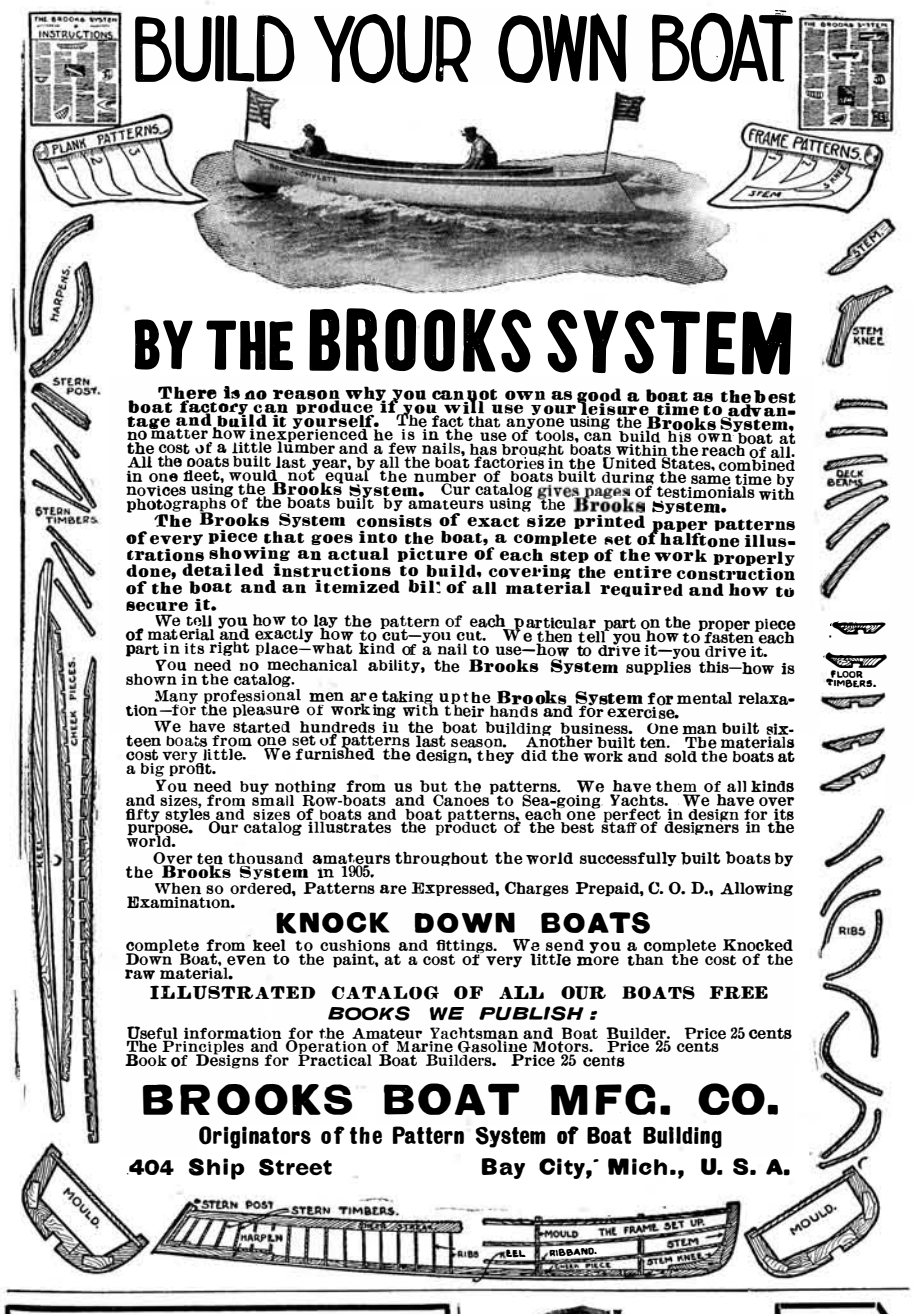

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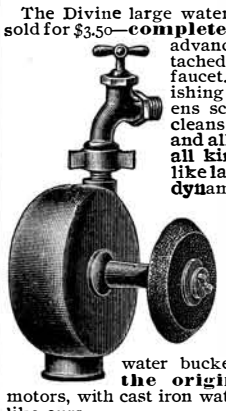

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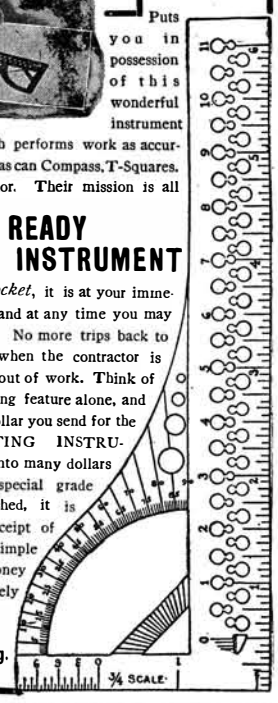

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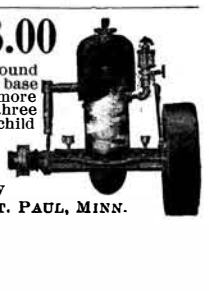

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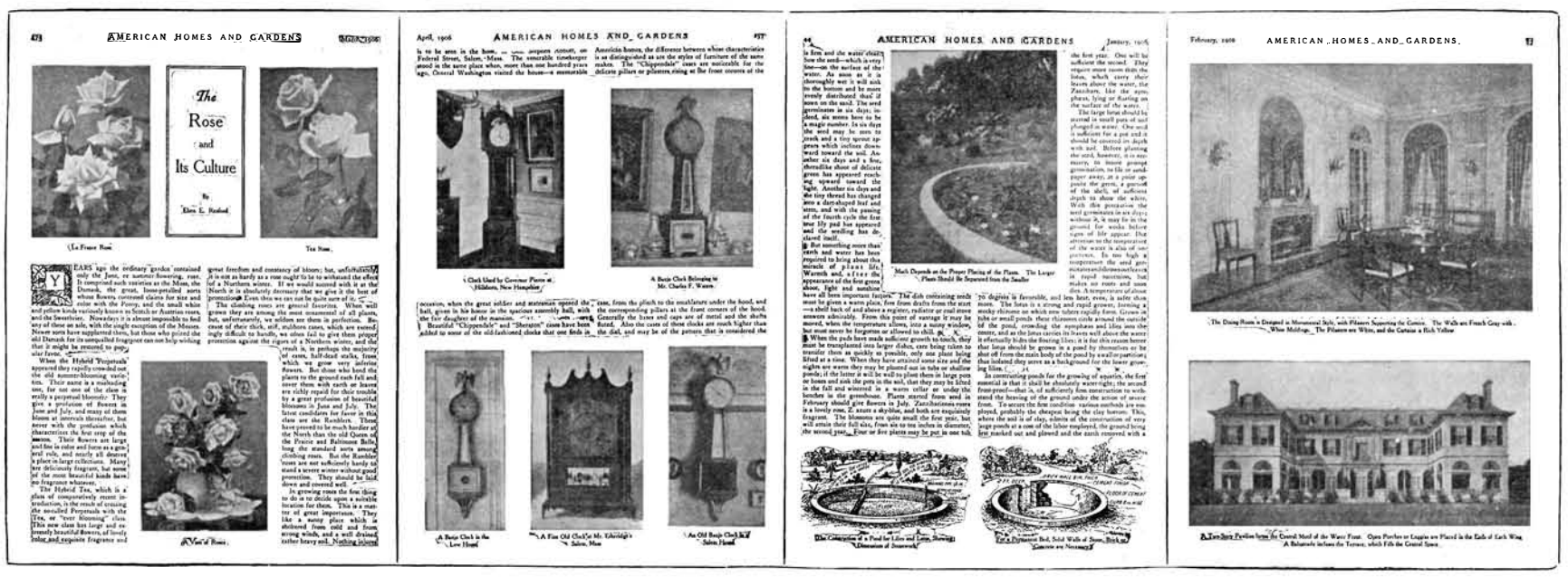
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FAC-SIMILE PAGES OF

American Homes and Gardens

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- Inexpensive Country Homes (with plans)
- Interior Decoration
- How Curtains May Be Made at Home
- How to Make Pottery at Home
- How Furniture May Be Covered at Home
- How the Amateur May Decorate the Room with Home-made Stencils
- How to Preserve Wild Flowers
- How a Water Garden May Be Laid Out and Built
- How the House of a Bygone Day May Be Remodeled and Converted Into a Modern Home
- How To Do Copper and Brass Repoussé Work
- How to Rehabilitate Worthless, Run-down Farms with $1000 or Less
- The Use of Statuary for Garden Decoration
- The Kitchen and How it Should Be Planned
- Historical Places in America
- The Entrance to a Country Place
- The House of the Colonial Period
- Sun Dials
- Modern Dahlias
- Gateways to Estates
- Nature Study and Its Effect on the Home
- Old Time Wall Paper
- Something Concerning Driveways
- My Garden Without Flowers
- A Seventeenth Century Homestead
- Wild Animals in Captivity
- How a Pennsylvania Farmhouse was Transformed Into a Beautiful Dwelling
- Electricity in the Home for Cooking, Ironing, Heating, etc.
- Life on an Olive Ranch
- A Neglected Opportunity—the House Roof
- Rapid Growth of Birds
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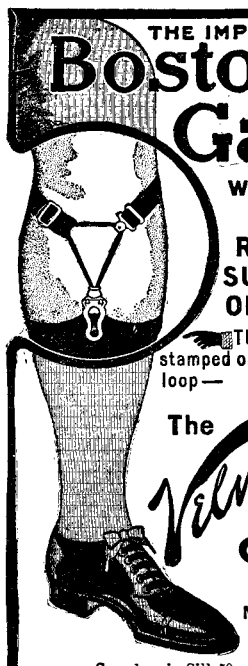

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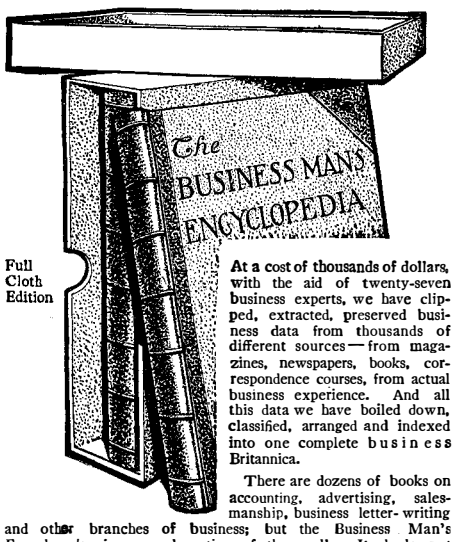

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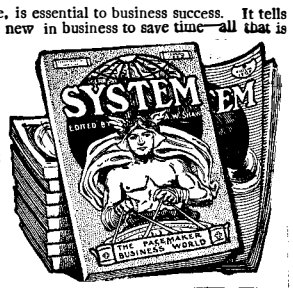

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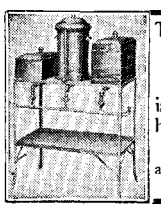

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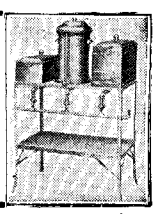

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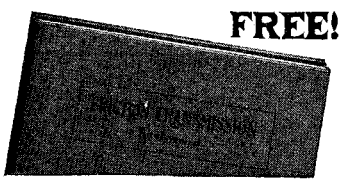

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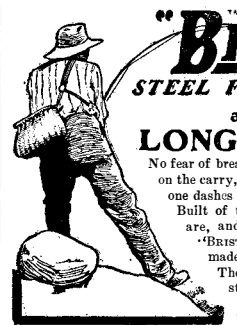

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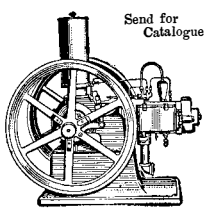

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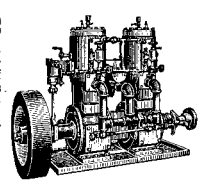

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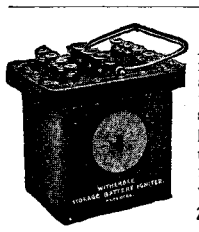

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P'anos and piano players, self-playing, Autopiano Co.	51,161
Pills for biliousness and constipation, Munyon's Homoeopathic Home Remedy Co.	51,148
Pottery ware, ornamental, American Terra Cotta and Ceramic Co.	50,994
Pulleys, blocks, and parts thereof, Boston & Lockport Block Co.	50,869
Pulleys, sash, Norris Sash Pulley Co.	50,822
Razors, Challenge Cutlery Corporation	50,923
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Remedies for certain named diseases, H. A. Blair	50,923
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Remedy for certain named diseases, C. L. Wells	51,004
Remedy for certain named diseases, G. C. Hanford Manufacturing Co.	51,073
Remedy for certain named diseases, J. E. Hanson	51,171
Remedy for the nerves, B. H. Bacon Co.	51,011
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Rings, gold, S. W. Lindsay	50,980
Rings, solid gold finger, Peckham Seamless Ring Mfg. Co.	51,152
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Ship logs and sounding machines, Thomas Walker & Son	50,840
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Shirts, negligee and dress, J. M. Robinson, Norton & Co.	50,975
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Soap, Kendall Mfg. Co.	50,879
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Soap, laundry, Prouty-Bowler Soap Co.	51,044
Soap, polishing, Kendall Mfg. Co.	50,878
Soap, scouring, Bon Ami Company	50,848
Soap, toilet, Medical Lake Salts Mfg. Co.	50,885
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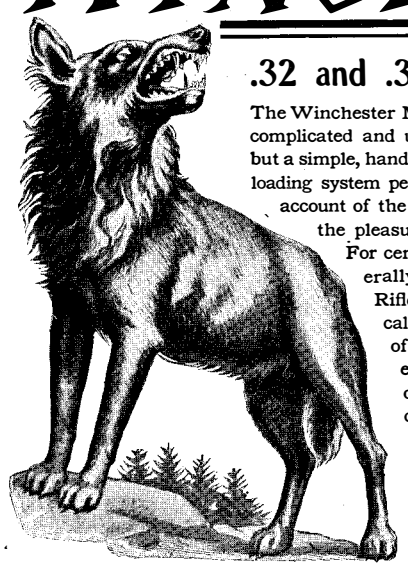

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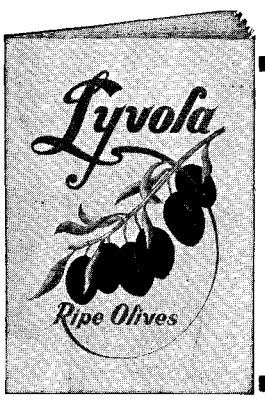

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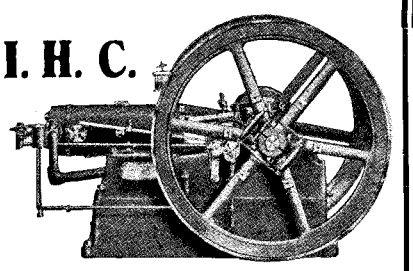

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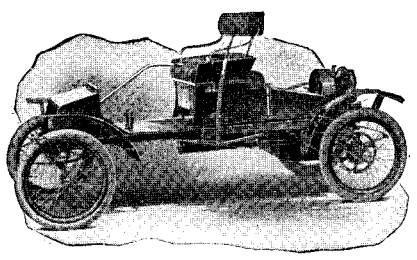

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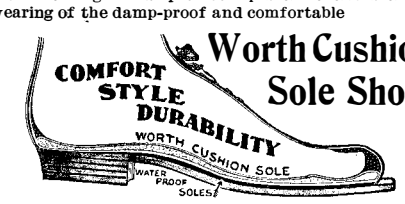

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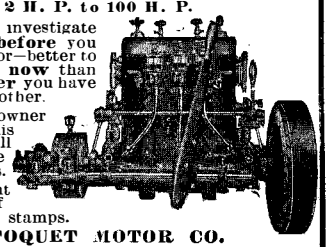

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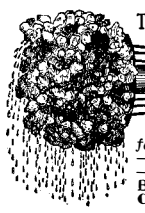

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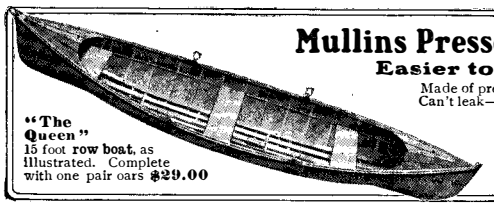

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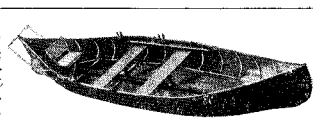

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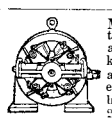

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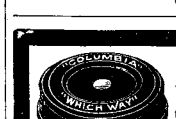

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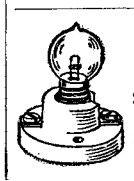

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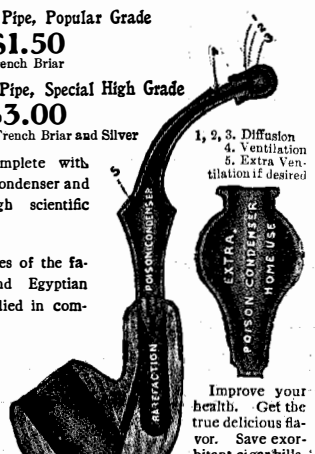

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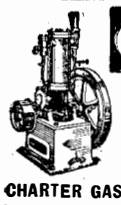

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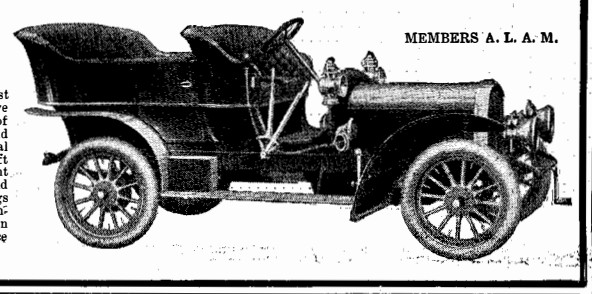

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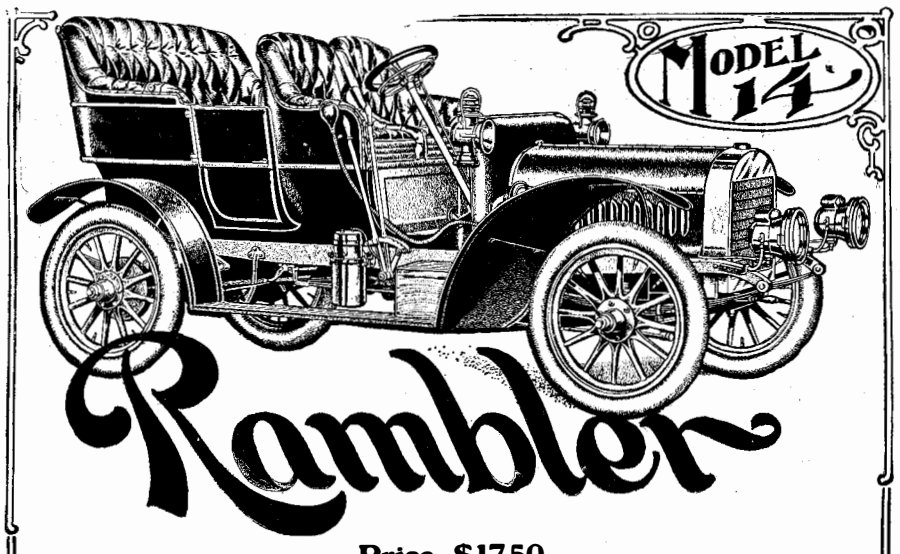

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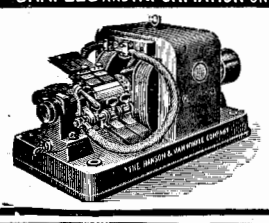

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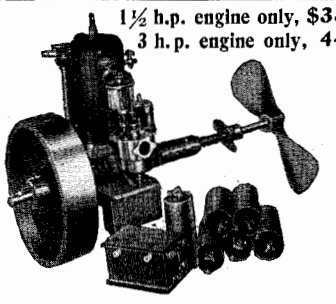

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